THE COLLECTING NET

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EVOLUTION OF THE CHEMICAL ROOM

By Oliver S. Strong
Professor of Neurology and Neuro-Histology in Columbia University.

The writer has been requested to give a brief sketch of the history of the institution known as the Chemical Room of the Marine Biological Laboratory at Woods Hole and also the system upon which it is run. Both owing to lack of time and to the limitation of space not much more than a very hasty sketch can be given, largely from memory, fortified by some figures taken from various records available.

The history of the Chemical Room dates back into the dim past of the Marine Biological Laboratory. We first find it emerging, apparently, as an entity with George W. Hunter as "Storekeeper" in 1897. This individual, by the way, is the one whose text-book of Biology has in more recent times been one of the sources of irritation to the Fundamentalists, culminating in the famous Scopes trial. In 1899 we find the title of his position changed to "Chemist", a title which has been maintained until the present day. It may be remarked parenthetically that the old Latin proverb

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LABORATORY ACTIVITIES

Friday, July 8
4:00 - 6:00 P. M.

M. B. L. Tea. Members of the Executive Board receiving.

Tuesday, July 12
8:00 P. M.

Evening Lecture. DR. EDWIN G. CONKLIN, Prof. of Biology Princeton University. Subject: "Localization Phenomena in Embryology".

Friday, July 15
8:00 P. M.

Evening Lecture. DR. E. M. LANDIS, University of Pennsylvania. Subject: "Permeablity of the Capillary Wall".

Saturday, July 9
9:00 - 12:00 P. M.

Club Dance. Orchestra. M. B. L. Club. Admission free to members; 75c for non-members.

DR. HEILBRUNN GIVES LECTURE

The outstanding impression that Dr. Heilbrunn gave in his lecture (the second of this year's series) is that protoplasm, though quite a complex mixture of substances some of which may vary from plant to animal and from species to species, acts in a surprisingly uniform manner under diverse influences. Even if it is a *potpourri* it acts like a uniform substance. "It is profitable, therefore to speak of the colloid chemistry of protoplasm, just as it is possible to speak of the colloid chemistry of soaps or proteins."

Perhaps one reason why mixtures, or rather *obvious* mixtures behave very much like "pure" substances under many conditions, is that the "pure" substances are not pure, and that frequently minute traces of materials, scorned in most chemical analyses, may produce astonishing effects. Thus absolutely pure iron has not yet been prepared; but the purest iron so far made is quite a different metal from what we all know. And "absolute" alcohol, according to the official tables, is supposed to boil at about 78 degrees C.—but Prof. H. B. Baker kept absolute alcohol over phosphorus pentoxide for 9½ years, and found that its boiling point was then about 38 degrees C. Under similar circumstances the boiling point of metallic mercury also went up 60 degrees C., and benzene, heptane, acetone, and other substances showed large though lesser advances. Obviously, mere traces of water can produce astounding effects. And any one who has worked with colloids knows the necessity for meticulous care in avoiding unwanted impurities, and the curious results produced by small amounts of this or that. Thus, about three parts of gelatin per million will *sensitise* collodial gold sols against coagulation by sodium chloride; but if very little more be used, the gelatin protects the gold against this calamity.

"The average biologist is not so much concerned as to whether it flows readily or not; that

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Naming of Woods Hole Is Traced to Norsemen

"THE STORY OF WOODS HOLE"

DR. EDWIN GRANT CONKLIN
Professor of Zoology, Princeton University

We open the first number of our second volume with one of a series of articles in which Dr. Conklin will relate to us the history of Woods Hole. Later he will describe to us the founding and the first days of the Marine Biological Laboratory. No one is so eminently fitted for the task that Dr. Conklin has undertaken, and we consider ourselves fortunate in having the privilege of placing this fascinating story before our readers.

After the manner of Knickerbocker's "History of New York", or Wells' "Outline of History", the Story of Woods Hole should begin with the glacier that made our hills and holes. Following the glacial epoch, should come the peopling of this region with plants, animals, and Indians. Unfortunately there are no living witnesses or written records of those prehistoric times, nor of the much later period when the Norsemen visited this coast and named it "Vineland the Good". Our only relic of the Norsemen is found in the former spelling of Woods "Holl", which was supposed to be Norse for "hill" and accordingly the original spelling "Hole" was formally changed to "Holl" in 1877 and a stone on the small arched bridge over the inlet to the Eel pond recorded this change, until that bridge was removed and the present drawbridge constructed about fifteen years ago. The official name of this place was "Woods Holl" from 1877 to 1896 when the U. S. Postoffice changed the name back to "Hole", much to the disgust of many, including Prof. Whitman, who had named certain local species "hollensis". The stone tower on the hill between Little Harbor and Nobska, now built into Mr. Carleton's house, was not a relic of Norse occupation, as many persons supposed, but was a water tower built by Mr. Glidden about 1870, and for obvious reasons was long known as the "Rustic Spoon Holder".

Before the coming of Europeans, Indians were fairly numer-

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MIXER MARKS START OF SOCIAL SEASON

The local social season began auspiciously on Saturday evening, July 2, with the M. B. L. Mixer, the annual party given by members of the Club, under the direction of Mrs. C. H. Farr and her committee.

The clubhouse was beautifully decorated with daisies, coryopsis, smilax and privet, and Japanese lanterns were strung outside for a garden party. The occasional spatterings of rain during the evening failed to dampen the spirit of the party. There was a genial attempt to become better acquainted with fellow workers and as the party ended it was noted that there had been gratifying success. The Jerry Bowes orchestra which played from 10 to 12 added much to the gaiety of the party, and in its humble way even the floorwax aided in smoothing out the latter part of the entertainment from a sort of bobbing folk dance to the undulations of a ball.

Refreshments served earlier in the evening consisted of ice cream, cup cakes and mints, a delightful innovation from the ice cream cones occasionally served.

Members of Mrs. Farr's committee, who aided materially in the success of the party, were Dr. Alvalyn Woodward, Mrs. W. W. Crawford, Mrs. Walter E. Garry and Miss Elizabeth Kinney. Four of the girls from the chemical room were kept busy during the evening tagging the guests as they appeared, with their names and institutional connections. It was estimated that more than three hundred guests were present at the Mixer.

Naming of Woods Hole Is Traced to Norsemen

(Continued from Page 1)

ous here, especially along the Bay Shore, as is proved by shell-heaps, arrowheads, graveyards, and Indian names of places. Some of their descendants are still left at Mashpee, Gay Head and Indian Hill on the Vineyard. John Eliot, Apostle to the Indians went through this region preaching to the aborgines.

The earliest record of English discovery and settlement on this Continent is that of Capt. Bartholomew Gosnold in May 1602, five years before the settlement of Jamestown, and 18 years before the landing of the Pilgrims at Provincetown and Plymouth. Gosnold coasted along "Cape Cod" and "Martha's Vineyard", which he so named. It seems probable from his account that he anchored at Vineyard Haven and later landed at what is now Woods Hole May 31, 1602. He named the island, called by the Indians "Cuttyhunk", "Elizabeth" in honor of his Queen, and to this day the chain of islands between Buzzards Bay and Vineyard Sound is called the "Elizabeth Islands", and the township is known as "Gosnold". A monument to Gosnold was placed on Cuttyhunk, near the place where he had built a fortified house in 1602. He also made a settlement near what is now Falmouth, known as "Succanessett", and the present seal of the Town of Falmouth bears the inscription "Succanessett 1602."

In 1606 Champlain sailed along this coast as far as the Hole, which it is said he mistook for a river and named "Champlain". Although other locations have since been named in honor of Champlain, the Hole between Buzzards Bay and Vine-Yard Sound is the only spot to which he himself attached his name. The historian Bourne has proposed that the Hole should be called "Champlain Strait", but the Yankee love of plain and homely names still prevails in such designations as "Woods Hole", "Buzzards Bay", Crow Hill", etc.

In 1907 after the "Jamestown Tercentenary", the residents of this region bethought themselves of the earlier discovery and settlement here in 1602 and held a "Gosnold Tercentenary", five years late. At this "Gosnold Tercentenary", the Laboratory Schooner, "Vigilant", re-christened and refitted for the occasion as Gosnold's ship "Concord", sailed into Great Harbor and landed Captain Gosnold (Mr. Purdam) and his officers in front of the Breakwater Hotel. Friendly Indians received them with presents of sassafras, and the Sachem smoked the pipe of peace with Gosnold. They then proceeded to Falmouth and dedicated the Memorial Boulder just beyond the Railroad Crossing at the entrance to the village.

The settlement at Succanessett was soon abandoned, and the present town of Falmouth was first settled in 1660 by people from West Barnstable. Woods Hole land was first apportioned among its thirteen settlers on the 23rd of July, 1677. Quisset was settled in 1691.

There were many stirring events hereabouts during the Revolutionary War. British War Vessels were often in Vine yard Sound and especially at Tarpaulin Cove. A British fleet of ten sails visited Woods Hole, April 1st, 1779; marines killed cattle and attempted burn the town, but were driven off. They returned April 3rd and cannonaded Falmouth, but were prevented from landing by four companies of militia of about 200 men. At one time a schooner laden with corn from Connecticut, was seized by a British privateer as he was entering the Sound and taken to Tarpaulin Cove. Col. Dimmick, who commanded the militia of the town, was notified of this and with twenty men in three whale boats, he pulled to the Cove, seized the schooner and sailed away with her, finally bringing her into Woods Hole.

In 1812, the British frigate "Nimrod", bombarded Falmouth and destroyed many buildings. She landed marines in Little Harbor and destroyed property there.

Most of this early history I have drawn from a book entitled "Three Lectures on the Early History of the Town of Falmouth, covering the time from its Settlement to 1812. Delivered in the year 1843 by Mr. Charles W. Jenkins of Falmouth. Edited by Edward H. Jenkins, New Haven, Conn. Falmouth, Mass.: 1889."

For the following notes on the early history of Woods Hole I am indebted to our fellow townsman, Mr. Frank L. Gifford who has painted several very interesting pictures from old sketches and descriptions, and at a later period from photographs and his own recollections of the village.

The earliest settlements at Woods Hole were around Little Harbor. The oldest house stood on the south-east side of the harbor and is now built into the Sargent house. On this side of the harbor were an old grist

mill and a salt mill and salt pans in which sea water was evaporated by the sun's heat for sea salt.

At a later date, about 1845, an old red school house stood at the head of the harbor, about where the railroad now runs. Back of this were the Purdam house, the Ferguson house and the Fay house, all now standing, and on the west side of the harbor was Joe Parker's Tavern, which long since disappeared and which was a favorite resort of Daniel Webster when on fishing trips to Woods Hole. Joe Parker operated a ferry to and from Martha's Vineyard which was the only regular connection between the island and the mainland.

Still later, about 1860, two hotels or taverns stood on the west side of Little Harbor, one of these the Dexter House, only just torn down, the other the Webster House, long since destroyed, which stood between the Dexter House and the present railroad station.

Between 1815 and 1860 Woods Hole was a center of the whaling industry. Nine whaling ships made this their port and the Bar Neck Wharf, where the Penzance Garage now stands, was a busy place outfitting these whalers and receiving their cargoes of oil and whalebone on their return. The old Stone Building, or Candle Factory, was built in 1829, and still contains certain evidences of its former uses; the old shingled building adjoining it on the south-east was a bake shop, where sea biscuit for the long voyages around the Horn was baked. Other buildings, now gone, were a rope-walk where rope was made, a cooper shop for making hogsheads to hold the oil, a blacksmith shop, etc. With the discovery of petroleum in western Pennsylvania, the whaling industry rapidly declined and died, and these old buildings were for a long time practically unused until the Marine Biological Laboratory acquired them and converted them to a new kind of whaling industry.

About 1850 Mr. Joseph S. Fay, crusing along this coast, sailed into Little Harbor, went ashore and bought a farm, and later added to it many barren and rocky acres. The whole region at this time was practically treeless. Mr. Fay set to work importing and planting many trees over his estate, and from this there developed the well-known "Fay Woods", with their beautiful woods-roads which were open to all visitors, and were the joy of early workers at the Laboratory. Alas! these woods are now sadly depleted by the gypsy moth, the golf course, and the inroads of civilization. Mr. Fay's interest in trees and in reforestation explains a clause in the deed of the Gansett property to the Laboratory, forbidding the cutting down of trees except where necessary.

Another famous estate in the vicinity of Woods Hole is Naushon and the adjoining islands, formerly owned by Mr. John M. Forbes. This was described by Oliver Wendell Holmes in the "Autocrat of the Breakfast Table" as "the finest private domain in America", and as he watched from the porch of the Forbes house on Naushon the schooners tacking back and forth in the Sound, he wrote his beautiful poem, "Light and Shade".

Both Mr. Fay and Mr. Forbes were generous friends of the Laboratory at a time when it had few financial supporters and very meager prospects, and it is fitting that in the days of our prosperity we should remember with especial gratitude the debt of the Laboratory to these generous friends.

Following whaling days the only commercial venture of note at Woods Hole was the Pacific Guano Works, of unsavory odor and memory, for its failure about 1880 brought financial disaster to many residents of Woods Hole. It was located near what is now the entrance to Penzance. Here stood the old red factory buildings and tenement houses, and here the odor of guano lingered until the plant was demolished and the present Penzance property was established more than twenty years later. It is interesting to note that Penzance was formerly an island, especially at high tide. When the Guano Company located there they built the stone wall along the side of the road at the entrance of Penzance as a breakwater. The present Breakwater Hotel owes its name to this wall, as it owes its original construction to one of the old tenement houses of the guano works. In the early days of the Laboratory the wharves and sheds of the Guano Company were the favorite bathing place for the men at the Laboratory. Here we swam without even a one-piece bathing suit, and the long distance diving from the high pier was one of the major sports of that time.

This brings the story of Woods Hole down to the time when it began to acquire biological significance, and that must form the subject matter of another chapter.

The Collecting Net

A weekly publication devoted to the activities of the Marine Biological Laboratory and of Woods Hole in general.

(Application for entry as second-class matter is pending.)

The Universal Press
New Bedford Woods Hole
Massachusetts

Prospectus

With this issue *The Collecting Net* enters upon the second year of its existence. This summer it will reflect more truly the "personality" of the laboratory. With the foundation of last year's experience upon which to build we are confident that we can create something of permanent and lasting value.

We look back upon our rushed and stormy existence of last season with mixed feelings of admiration and disgust. There is room for enormous improvement, but the process of adaptation could not be a sudden one. We have survived the first year of our struggle for existence and of this fact we are proud. We look forward with anticipation to our rapidly accelerated growth and improvement, and with the cooperation of all those connected with the laboratory we cannot help but bbe successful.

The Scholarship Fund

The Collecting Net began life with rather definite plans as to how it could be of benefit to the Marine Biological Laboratory. One of the more important, perhaps, was the possibility of initiating a scholarship fund to assist deserving students to return to Woods Hole to carry on independent investigations. There are many ways in which this might be done, but after lengthy deliberation and expert counsel the following plan seems to be the most satisfactory: A sum of money will be awarded at the end of the season to a couple of the "most deserving" students registered in one of the five courses given at the Laboratory. The clause "most deserving" has yet to be defined. Especial weight, however, will be given to the following factors: (1) the financial condition of the applicant; (2) the character of his or her work during the present summer; (3) the general adaptability of the awardee to the laboratory community. The awards will be made by a committee appointed by the Director of the Marine Biological Laboratory.

Any money received from our paper in excess of expenditures will be turned over to the scholarship fund. In initating this plan we are well aware that our contribution may not be a large one; but we are confident that a great many people connected with the laboratory, and others interested in its welfare, will be only too glad to assist in building up a presentable sum of money. Tentatively we have set the lower limit at two hundred dollars, but there seems to be no obvious reasons why this amount can not be exceeded. Checks should be made payable to the "C. N. Scholarship Fund".

The cost of the printing and paper alone for this number of *The Collecting Net* amounted to more than $180.00. If 500 copies are sold the receipts from this source will be only about $70.00. These figures bring out with startling clearness the extent to which we are dependent upon our advertisers.

Every paper urges its readers to purchase material from its advertisers, and we must do likewise, trite as it may seem for us to write about it. But in our case the reasons are more urgent and the results are more direct. Every reader is intensely interested in the development of the laboratory. An extra column of advertising means that the sum of twelve dollars will be turned over to the Collecting Net Scholarship Fund. This money will be used not only directly to assist a deserving student, but indirectly to forward the interests of the laboratory and promote biological research.

Readers will render a greater service than is perhaps realized if they will not only give first choice to the firms that advertise, but, if on making inquiries or on purchasing material, they will make mention of the fact that the announcement in question was seen in the columns of *The Collecting Net.* Every firm advertising in *The Collecting Net* will be only too glad to answer inquires and to send catalogs if you are in any way interested in the materials that they handle.

BIGELOW TO LEAD CLUB THIS SEASON

The annual meeting of the M. B. L. Club was held Tuesday evening, July 5. The reports of standing committees were read, and various recommendations were made for the consideration of the new committees. The nomination committee presented a majority report, and Dr. Lewis of the committee presented a minority report in which he nominated Mrs. E. L. Clark for president. As a fitting reward for her service to the club Mr. Clark was elected president, but found it impossible to serve. The following officers were elected: Pres. Dr. R. P. Bigelow, V. Pres. Miss Mary MacDougall, Sec-Treas. Mrs. S. H. Farr.

The retiring officers, under whose regime many improvements in the club have been accomplished, are: Pres. Dr. D. J. Edwards, V. Pres. Dr. C. C. Speidel, Sec.-Treas. Dr. Myra Sampson.

EPISCOPAL CHURCH ENTERTAINS M. B. L.

The Episcopal Church once more opened its doors to members of the M. B. L. who were received as guests at a social gathering held at the Parish House of the Church on the evening of July 6. The graciousness of Rev. James Bancroft and members of the parish made every one genuinely enjoy the evening.

Colored lanterns strung out on the lawn gave hint of the occasion, and inside, the house was festive with bunches of syringa and nasturtiums. Decorating the table were large bouquets of roses in a variety which suggested the vivid profusion of Miss Fay's garden.

The assembly room upstairs was devoted to dancing. Handy's orchestra in a bower of blossoms officiated capably upon the platform, and with the hard maple floor provided a combination which the younger set present was reluctant to leave, except, perhaps, to partake of the enticing ice-cream, cake and punch served below by members of the Church Work Association.

In the receiving line were the Rev. Bancroft, Mrs. H. H. Fay, Miss S. E. Bancroft, Miss Florence Fish, and Mrs. W. O. Luscomb, all representing the Church. From the M. B. L. were Mrs. C. H. Farr, Mrs. W. E. Garrey, Mrs M. H. Jacobs, Mrs. Higgins, Mrs. Linton, Mrs. Galtsoff, Dr. A. Woodward, Dr. C. Parkard, and Dr. D. J. Edwards.

THE CHEMIST-GENERAL

(Apologies to W. S. Gilbert, the Pirates of Penzance and all Major-Generals)

I am the very pattern of a modern chemist gineral,
I've information vegetable, animal, and mineral.
I am well up in physics — quote experiments historical,
From Thales, Volta, Faraday, in order categorical.
Equations both of integral and differential calculus,
I use to plumb the vagaries of beings animalculus—
In fact in matters vegetable, animal, and mineral,
The colloid chemist shows he is a modern chemist gineral.

The filter-passing haze that spoils your very best analysis,
The ferments that will wreck your final product by catalysis,
The mists, and fogs, and clouds that go to make the weather fair or foul,
The smokes a gas-mask won't adsorb, but make the soldiers swear or howl,
And where the agate gets its rings and how the comet swings its tail,
And how the pearly nautilus on tropic waters flings its sail—
In all these matters vegetable, animal, and mineral,
You'll find the colloid chemist is a modern chemist gineral.

If you would know how plants suck up their food by capillarity,
The differences in grade of crops, the cause of their disparity,
If you would use the messes that organic chemists cuss like sin,
See life-like ultramicrons wriggle in a sol of protein—
If you would know of rubber, glue soap, leather or linoleum,
Of baking, dyeing, fabrics, foods, flotation, or pertoleum—
Recall in matters vegetable, animal and mineral,
The colloid chemist proves he is a modern chemist gineral.

pH. D.

DIRECTORY FOR 1927

Abbreviations

Botany Building..............Bot.
Brick Building................Br.
Lecture Hall...................L.
Old Main Building..........O. M.
Rockefeller Building ....Rock.

The abbreviations used for the positions and institutions are the same as those incorporated in "American Men of Science." Thus, taking Dr. Amberson as an example, his position during the regular college year is assistant professor of physiology at the University of Pennsylvania. His work at the laboratory is carried out in the Brick Building in Room 309.

THE STAFF

Jacobs, M. H., Director, prof. gen. phys. Pennsylvania.

ZOOLOGY

I. Investigation

Conklin, E. C., prof. zool. Princeton.
Grave, C., prof. zool. Washington (St. Louis)
Jennings, H. S., prof. zool. Hopkins.
Lillie, F. R., prof. emb. Chicago.
McClung, C. E., prof. zool. Pennsylvania.
Mast, S. O., prof. zool. Hopkins.
Morgan, T. H., prof. exp. zool. Columbia.
Parker, G. H., prof. zool. Harvard.
Wilson, E. B., prof. zool. Columbia.
Woodruff, L. L., prof. zool. Yale.

II. Instruction

Dawson, J. A., instr. zool. Harvard.
Martin, E. A., asst. prof. zool. C. C. N. Y.
Cole, E. C., asst. prof. zool. Williams.
Bennitt, R., instr. biol. Tufts.
Bissonnette, T. H., prof. biol. Trinity.
Grant, Madeleine P., asst. prof. zool. Mount Holyoke.
Severinghaus, A. E., Columbia University.
Young, D. B., assoc. prof. biol. Arizona.

PROTOZOOLOGY

I. Investigation
(see zoology)

II. Instruction

Woodruff, L. L., prof. zool. Yale.
Calkins, G. N., prof. protozool. Columbia (absent 1927)
MacDougall, M. S., prof. zool. Agnes Scott.
Unger, W. B., asst. prof. zool. Dartmouth.

EMBRYOLOGY

I. Investigation
(see zoology)

II. Instruction

Goodrich, H. B., prof. biol. Wesleyan.
Grave, B. H., prof. biol. Wabash.
Packard, C., assoc. inst. Cancer Res. Columbia .
Plough, H. H., prof. biol. Amherst.
Rogers, C. G., prof. comp. phys. Oberlin.

PHYSIOLOGY

I. Investigation

Bradley, H. C., prof. phys. chem. Wisconsin.
Garrey, W. E., prof. phys. Vanderbilt Med.
Lillie, R. S., prof. gen. phys. Chicago.
Mathews, A. P., prof. biol. chem. Cincinnati.

II. Instruction

Jacobs, M. H., prof. gen. phys. Pennsylvania.
Fenn, W. O., prof. phys. Rochester.
Michaelis, L., prof. Berlin; Hopkins.
Hartline, H. K., Hopkins.
Haywood, C., instr. zool., Vassar.

BOTANY

I. Investigation

Duggar, B. M., prof. bot. phys., Wisconsin.
Allen, C. E., prof. botany Wisconsin.
Brooks, S. C., prof. zool. California.
Robbins, W. J., prof. botany Missouri.
Schramm, J. R., Editor-in-chief, Biological Abstracts, Pennsylvania.

II. Instruction

Lewis, I. F., prof. biol. Virginia.
Taylor, W. R., asst. prof. botany, Pennsylvania.
Poole, J. P., prof. evol. Dartmouth.

INVESTIGATORS

Abell, R. G., instr. biol. Hampton Inst.
Allen, Eleanor, grad. Brown.
Amberson, W. R., asst. prof. phys., Pennsylvania Med. Br. 309
Armstrong, P., instr. anat. Cornell Med. Br. 318
Arnold, Constance W., demonstrator. Brown. Br. 233.
Austin, Mary L., lect. Barnard College. Br. 315
Baker, Lillian E., asst. Dept. Exp. Surg. Rockefeller Inst. O. M. Base.
Barth, L. G., asst. zool. Michigan. Br. 217A
Bartholomew, W. W., res. stud. Columbia.
Baskerville, Margaret, adj. prof. Texas Med. Br. 315.
Belling, J., fellow. Carnegie Inst. Br. 223.
Bennitt, R., instr. zool. Tufts. O. M. 25.
Bigelow, R. P., prof. zool., Mass. Inst. Tech. Br. 234.
Bissonnette, T. H., prof. biol. Trinity. O. M. 26.
Blackford, S. D., instr. med. Va. Lab. Physicians. Dorm. Room 103.
Blanchard, K. C., asst. prof. biochem New York. Br. 325.
Blumenthal, R., grad. phys. Pennsylvania. Br. 217O.
Bowen, R. H., assoc. prof. zool. Columbia. Br. 327.
Bradley, H. C., prof. phys. Wisconsin. Br. 122A.
Breitenbenbecher, J. K., lect. zool., McGill. L. 25.
Bridges, C. B., res. asst., Carnegie Inst. Br. 332.
Bronfenbrenner, J. J., assoc., Rockefeller. Br. 208.
Bronk, D. W., assoc. prof. phys. Swarthmore. Br. 340.
Brooks, Mrs. M. M., California until July 2, Bot. 4.
Brooks, S. B., prof. zool., California until July 2.
Brooks, S. C., prof. phys., Rutgers. Bot.
Brown, D. E. S., instr. zool., New York. Br. 2.
Budington, R. A., prof. zool., Oberlin. Br. 218.
Campbell, C. J., asst. prof. phys., Syracuse. Br. 106.
Canavan, W. P., instr. zool., Pennsylvania. Br. 217.
Carothers, E. Eleanor, lect. zool., Pennsylvania. Br. 221.
Carpenter, Esther, asst. zool. Wisconsin. Br. 111.
Carver, G. L., prof. biol., Mercer. Br. 315.
Cattell, M., phys. Cornell Med. Br. 214.
Cattell, W., Res. fellow biol., Memorial Hosp., N. Y. Br. 123.
Chambers, R., prof. micr. anat., Cornell Med. Br. 328C.
Cheer, S. N., fellow of Rockefeller Foundation, Peking Union Med. college. Br. 107.
Chen, C. C., prof. biol., Shanghai, China. Br. 322.
Chen, T. Y., grad. stud., protozool., Columbia. Br. 314.
Chidester, F. E., prof. zool., West Virginia. Br. 344.
Christie, J. R., assoc. nematologist, U. S. Dept. Agr. Rock. East.
Clark, Eleanor L., grad. anat. Pennsylvania Med. Br. 117.
Clark, E. R., prof. anat., Pennsylvania Med. Br. 117.
Clark, L. B., grad. zool. Johns Hopkins. Br. 315.
Clowes, G. H. A., direc. Lilly Research Lab. Br. 328.
Cobb, N. A., agr. technologist. U. S. Dept. Agr. Rock. East.
Cohen, B., chem. Hygienic Lab. (D. C.) Br. 324.
Cohn, E. J., asst. prof. phy. chem. Harvard Med., Br. 109.
Cole, E. C., asst. prof. biol. Williams. O. M. 24.
Cole, K., nat. res. fellow. Harvard. Br. 114.
Conklin, E. G., prof. biol., Princeton. Br. 225.
Copeland, J., asst. biol. Earlham (Ind.) Bot.
Copeland, M., prof. biol., Bowdoin. Br. 334.
Cowdry, E. V., assoc. Rockefellow Inst. Br. 209A.
Cowles, R. P., assoc. prof. zool. Johns Hopkins. Br. 222.
Crawford, W. W., fellow zool. Missouri. Br. 217.
Crocker, W., direc. Boyce Thompson Inst.
Curtis, W. C., prof. zool. Missouri. Br. 336.
Darby, H. H., instr. phys. New York. Br. 2.
Dawson, J. A., instr. zool. Harvard, O. M. 28.
Dellinger, S. C., prof. zool. Arkansas, Bot.
Disalvo, Mrs. B., asst. biol. George Washington H. S. Rock.
Dolley, W. L. Jr., prof. biol. Buffalo. Br. 339.
Donaldson, H. H., prof. neur. Wistar Inst. Br. 115.
Downing, R. C., grad. stud. Wabash. (Ind.) Br. 234.
Drew, Kathleen M., lect. bot. Manchester (Eng.) Bot. 4.
Duggar, B. M., prof. bot. phys. Wisconsin, Br. 122B.
Durrant, E. P., asst. prof. phys. Ohio State. Br. 3.
Edwards, D. J., assoc. prof. phys. Cornell Med. Br. 214.
Elftman, H., asst. zool. Columbia. Br. 314.
Emmart, Emily W., assoc. prof. biol. Western Maryland. Br. 126.
Esaki, S., asst. prof. Keio Med. (Japan). Br. 331.
Farr, C. H., assoc. prof. bot. Washington (Mo.) O. M. Base.
Farr, Mrs. W. K., Barnard Hosp. (St. Louis) O. M. Base.
Fenn, W. O., prof. phys. Rochester Med. Br. 341.
Field, Elsie, Radcliffe, Br. 213.
Field, Madeleine, asst. phys. Mt. Holyoke. Br. 122C.
Fish, H. D., grad. stud. Columbia. O. M. 34.
Fogg, J. M. Jr., instr. bot. Pennsylvania. Bot. 22.
Freeman, L. B., grad. stud. Pennsylvania. Rock.
Fry, H. J., asst. prof. biol. New York. O. M. Base.
Garrey, W. E., prof phys. Vanderbilt Med. Br. 215.
Gates, F. L., assoc. memb. Rockefeller Inst. Br. 209B.
Genther, Ida T., asst. zool. Wisconsin. Br. 122C.
Glaser, R. W., assoc. memb. Rockefeller Inst. Br. 209.
Glaser, O. C., prof. biol. Amherst. Br. 204.
Goodkind, R., stud. Harvard Med. Br. 109.
Goodrich, H. B. prof. biol. Wesleyan. (Conn.) Br. 210.
Goldfarb, A. J., prof. biol. C. C. N. Y. L. 34.
Gordon, Isabella, res. worker, Imperial College, London. Br. 335.
Graham, J. Y., prof. biol. Alabama. L. 22.
Grave, B. H., prof. zool. Wabash (Ind.) Br. 234.
Griswold, Sylvia, instr. biol. Penn. Col. Women Bot.
Gruenberg, B. C., direc. Am. Assoc. Med. Progress. O. M.
Grundfest, H., fellow, Columbia. Br. 314.
Hadley, C. E., grad. zool. Harvard. Br. 217.
Hague, Florence, asst. prof. biol. Sweet Briar. L. 24.
Hall, R. P., asst. prof. zool. New York. L. 32.
Hance, R. T., assoc. zool. Rockefeller Inst. L. 21.
Hann, H. W., instr. emb. Illinois. Br. 222.
Hansen, I. B., asst. zool. Wesleyan, (Conn.)
Harral, Ruth, Cornell Med. Br. 324.
Harrop, G. A. Jr, assoc. prof. med. Johns Hopkins Med. Br. 312.
Hartline, H. K., grad. phys. Johns Hopkins Med. Br. 229.
Harvey, E. N., prof. phys. Princeton. Br. 116.
Haywood, Charlotte, grad. phys. Pennsylvania. O. M. 6.
Hecht, S., assoc. prof. biophysics, Columbia. Br. 230.
Heilbrunn, L. V., asst. prof. zool. Michigan. Br. 330.
Heyroth, F. F., nat. res. fel. Harvard Med. Br. 110.
Hibbard, Hope, Preparateur, Sorbonne.
Hidalgo, F., asst. Rockefeller Inst. Br. 208.
Hiller, H., asst. biol. lab. Krakow (Poland) Br. 324.
Hoadley, L., asst. prof. biol. Brown. Br. 329.
Hof, Anne, grad. bot. Radcliffe. Bot.
Hofkesbring, Roberta, instr. phys. Tulane. O. M.
Holmes, Gladys E. grad. asst. Brown. Br. 315.
Hoskins M. M., asst. prof. hist. New York. L. 33.
Hoskins, R G., res. assoc. phys. Harvard Med. Br. 3.
Howe, H. E., editor Am. Chem. Soc. Br. 304.
Howe, T. D., instr. biol. James Millikin. Bot.
Howland, Ruth B., asst. prof. biol. New York. Br. 331.
Huettner, A. F., asst. prof. zool. Columbia. Br. 314.
Hughes, T. P., asst. Rockefeller Inst. Br. 206.
Inman, O. L., prof. biol. Antioch. Br. 114.
Irwin, Marion, assoc. phys. Rockefeller Inst. Br. 207.
Jacobs, M. H., prof. gen. phys. Pennsylvania, Br. 205.
Jennings, H. S., prof. zool. Johns Hopkins. Br. 126.
Johlin, J. M., assoc. prof. biochem. Vanderbilt Med. Br. 342
Johnson, P. L., grad. asst. zool. Johns Hopkins. Br. 311.
Johnson, R. H. Jr., res. stud. Columbia. O. M. 34.

INVESTIGATORS—Cont.

Just, E E., prof. zool. Howard Br. 228.
Kaltreider, N. L., Swarthmore. Br. 340.
Kapp, Eleanor M., asst. biol. New York. Br. 2.
Kaufmann, B. P., prof. biol. Southwestern (Tenn.) Br. 303.
Keefe, A. M., prof. biol. St. Norbert (Wis.) Bot. 5.
Keltch, Anna K., res. asst. Ely Lilly and Co. Br. 328.
Klein, H., grad. Pennsylvania. O. M. 7.
Kleiner, I. S., prof. chem. N. Y. H. Med. L. 23.
Knowlton, F. P., prof. phys. Syracuse Med. Br. 106.
Koch, Henry, tech., Rockefeller Inst. Br. 206.
Koehring, Vera, fel. zool. Pennsylvania. Br. 217n.
Kropp, B., zool. Harvard. Br. 217f.
Lancefield, D. E., asst. prof. zool. Columbia. Br. 1.
Lancefield, Rebecca C., asst. bact. Rockefeller Inst. Hosp. Br. 206.
Landis, E. M., grad. phys. Pennsylvania. Br. 205.
Lee, M. O., res. assoc. Harvard Med. Br. 3.
Lewis, I. F., prof biol. Virginia. Bot. 26.
Light, V. E., grad. Johns Hopkins. Br. 217k.
Lillie, F. R., prof. zool. Chicago. Br. 101.
Lillie, R. S., prof. gen. phys. Chicago. Br. 326.
Loeb, L., prof. path. Washington Med. (St. Louis) Br. 122C.
Lorberblatt, I., chem. Harriman Res. Lab. New York. Br. 122C.
Lu, H. L., grad. Columbia. Br. 314.
Lucas, Catherine L. T., trav. fel. zool. London. Br. 217g.
Lucas, E. R., instr. anat. Kansas.
Lucke, B., assoc. prof. path. Pennsylvania. Br. 310.
Lynch, Ruth S., instr. zool. Johns Hopkins. Br. 126.
Lyon, E. P., prof. phys. Minnesota Med. Br. 106.
Martin, E. A., asst. prof. zool. C. C. N. Y. O. M. 28.
Mast, S. O., prof. zool. Johns Hopkins. Br. 311.
Matthews, S. A., grad. Harvard. Br. 217e. Until June 28.
Mavor, J. W., prof. biol. Union. Br. 343.
May, R. M., res. fel. Am. Field Service (France). Br. 110. Aug. 15.
McCardle, R. C., grad. Michigan. Br. 217c.
McClendon, J. F., prof. phys. chem. Minnesota. Br. 342.
McClung, C. E., prof. zool. Pennsylvania. Br. 219.
McCutcheon, M., asst. prof. path. Pennsylvania. Br. 310.
MacDougall, Mary S., prof. zool. Agnes Scott. O. M. 21.
Macnab, Alleyne, tech. surg. Rockefeller Inst. Rock.
McNamara, Helen, tech. Rockefeller Inst. Br. 207.
Metcalf, M. M., res. assoc. zool. Johns Hopkins. Br. 203.
Metz, C. W., staff memb. Carnegie Inst. Cold Spring Harbor. Br. 223.
Michaelis, L., resident lect. Johns Hopkins Med. Br. 312.
Mitchell, P. H., prof. phys. Brown Br. 233.
Mitchell, W. H. Jr., fel. phys. Harvard. Br. 110.
Montgomery, H., Harvard Med. Br. 107.
Moore, Imogene, grad. Yale. Br. 217j
Morgan, T. H., prof. zool. Columbia. Br. 320.
Morrill, C. V., asst. prof. anat. Cornell Med. L. 27.
Morrison, M. E., grad. phys. Pennsylvania. Br. 110.
Moses, Mildred S., res. asst. Carnegie Inst. Br. 223.
Nelsin, O. E., instr. zool. Pennsylvania. Br. 217m.
Newman, H. H., prof. zool. Chicago. Br. 226.
Noble, G. K., curator, Dept. Herp. Am. Mus. Nat. Hist. Br. 306.
Nomura, S., asst. prof. zool. Tohoku Imp. (Japan) O. M. Base.
Nonidez, J. F., assoc. anat. Cornell Med. Br. 318.
Packard, C., asst. prof. zool. Inst. Cancer Res. (Columbia.) O. M. 2.
Parker, G. H., prof. zool. Harvard. Br. 213.
Parmenter, C. L., asst. prof. zool. Pennsylvania. Br. 220.
Parpart, Ethel R., asst. phys. Amherst. Br. 204.
Patterson, W. M., independent investigator zool. (New York) Br. 315.
Perlzweig, W. A., assoc. med. Johns Hopkins. Br. 312.
Phelps, Lillian A., instr. zool. Cornell. O. M. 3.
Pierce, Madelene E., grad. zool. Radcliffe. Rock.
Pinney, Mary E., prof. zool. Milwaukee-Downer. Br. 217h.
Plough, H. H., prof. biol. Amherst. Br. 125.
Pollock, K. H., Cornell Med. Br. 328.
Poole, J. P., prof. evolu. Dartmouth.
Pond, S. E., asst. prof. phys. Pennsylvania Med. Br. 224.
Rand, H. W., assoc. prof. zool. Harvard. L. 30.
Redfield, A. C., asst. prof. phys. Harvard Med. Br. 107.
Redfield, Helen, Nat. Res. Fel. zool. Columbia. Br. 314.
Reynolds, S. R. M., asst. phys. Swarthmore. Br. 340.
St. DeRenyi, G., asst. prof. anat. Pennsylvania. Br. 117.
Reznikoff, P., assoc. anat., instr. med. Cornell Med. Br. 324.
Rice, K S., assoc. prof. phys. Brown. O. M. 1.
Richards, A., prof. zool. Oklahoma. L. 26.
Richards, Mildred H., res. asst. Oklahoma. L. 26.
Ringoen, A. R., asst. prof. zool. Minnesota. Br. 217e.
Ritter, R. A., res. asst. Missouri State. Br. 336.
Rogers, C. G., prof. comp. phys. Oberlin. Br. 218.
Romer, A. S., assoc. prof. vert. palaeon. Chicago. L. 28.
Rowlee, Silence, asst. prof. bot. Elmira. Bot.
Runyon, E. H., instr. bot. Washington (St. Louis) Br. 110.
Sanders, Gertrude B., res. asst. Swarthmore. Br. 340.
Sayles, L. P., asst. prof. biol. Norwich (Vt.) L. 29.
Schaeffer, A. A., prof. zool. Kansas. Br. 333.
Schmitt, F. O., Nat. Res. Fel. phys. Washington (St. Louis) Br. 301.
Schrader, F., assoc. prof. zool. Bryn Mawr. O. M. 29.
Schrader, Sally H., instr. zool. Bryn Mawr. O. M. 29.
Schultz, J., Nat. Res. Fel. zool. Columbia. Br. 314.
Scott, Miriam J, inst. zool. Pennsylvania. Br. 221.
Sears, Mary, grad. zool. Radcliffe. Rock.
Severinghaus, A. E., inst. anat. Columbia. O. M. 31.
Shaftesbury, A. D., assoc. prof. zool. N. C. Col. Women. L. 31.
Shlaer, S., stud. asst. zool. Columbia. Br. 314.
Shoup, C. S., asst. zool. Princeton. Br. 111.
Sichel, F. J. M., phys. McGill. Br. 111.
Smith, G. H., instr. bot. Illinois. Bot.
Smith, Septima C., fel. med. zool. Johns Hopkins. Rock.
Smith, W. A., grad. asst. phys. Pennsylvania. Br. 309.
Sonneborn, T. M., grad. zool. Johns Hopkins. Br. 126.
Sribyatta, L., instr. phys. Chulalongkora Med. (Siam) Br. 111.
Stark, Mary B., prof. emb. N. Y. H. Med. L. 23.
Steen, E. B., instr. zool. Wabash (Ind.) Br. 234.
Steggerda, F. R., fel. phys. Minnesota. Rock.
Stewart, Dorothy R., instr. biol. Lake Erie. Br. 110.
Stockard, C. R., prof. anat. Cornell Med. Br. 317.
Stokey, Alma G, prof. bot. Mt. Holyoke. Bot. 5.
Strong, O. S., prof. neur. Columbia. chem. Rm.
Stunkard, H. W., prof. biol. New York. Br. 232.
Sturtevant, A. H., memb. staff Carnegie Inst. Columbia. Br. 1.
Sumwalt, Margaret, instr. phys. Pennsylvania. Br. 309.
Swett, F. H., assoc. prof. anat. Vanderbilt Med. Br. 339.
Taft, C. H. Jr., grad. phys. Columbia. Br. 217d.
Taylor, Jean Grant, Pennsylvania. Bot.
Taylor, W. R., prof. bot. Pennsylvania. Bot.
Titlebaum, A., asst. zool. Columbia. Br. 314.
Tracy, H. C., prof. zool. Kansas. L. 30.
Turner, Abby H., prof. phys. Mt. Holyoke. Br. 211.
Uhlenhuth, E, assoc. prof. anat. Maryland Med. Br. 122D.
Ullian, Silka S., res. asst. Carnegie Inst. O. M. 4.
Unger, W. B., asst. prof. zool. Dartmouth. O. M. 22.
Visscher, J. P., assoc. prof. biol. Western Reserve. L. 34.
Walden, Eda B., res. asst. Eli Lilly & Co., Research Lab. Br. 328.
Wear, J. H., res. asst. Harvard Med.
Weech, A. A., instr. med. Johns Hopkins. Br. 312.
Wells, H. S., Nat. Res. Fel. Med. Harvard Med. Br. 110.
Wenrich, D. H., asst. prof. zool. Pennsylvania. Br. 219.
Whedon, A. D., prof. phys. N. D. Agri. Br. 226 (Aug. 1)
Whitaker, D. M., grad. asst. zool. Stanford. Br. 332.
Willey, C. H., instr. biol. New York. Br. 217b.
Wilson, J. W., asst. prof. biol. Brown. Br. 329.
Wolf, E., asst. zool. Heidelberg. Br. 110.
Wolf, E. A., instr. phys. Pittsburgh. Br. 315.
Woodruff, L. L., prof. protozool. Yale. Br. 323.
Woodward, Alvalyn E., Research worker. Michigan. L. 24.
Wyman, J. W., instr. biol. Harvard. Br. 109.
Young, R. Arliner, asst. prof zool. Howard. Br. 228.
Young, D. B., prof. biol. Maine. O. M. 27.

STUDENTS

The abbreviations used are the same as in the list of investigators. In the case of Mr. Ballard, the information given is that he is an undergraduate student at Darthmouth College and that he is taking the course in botany at the laboratory. If the individual is a girl the first name is given.

Abell, Richard G., instr. biol. Hampton Inst. zool.
Adams, T. G., fel. biol. C. C. N. Y. proto.
Alexander, Eleanor G., grad. Columbia. proto.
Andrews, Ava Lee, asst. zool. North Carolina College, zool.
Apgar, Grace M., Pennsylvania. zool.
Bahrs, Alice M., asst. phys. California. phys.
Bailey, Jr., P. L., grad. Brown. emb.
Baily, Jr., J. L., fel. biol. Johns Hopkins. emb.
Baker, Carolyn. Vassar. bot.
Ballard, W. W., Dartmouth. zool.
Barron, E. S. G., fel. phys. Lima (Peru).
Beebe, Mary E., Oberlin. zool.
Beyer, Kathe M., Brown. emb.
Bilstad, Nellie M., asst. biol. Wisconsin. zool.
Blount, R. F., instr. zool. Arizona.
Bond, Evelyn, grad Pennsylvania zool.
Borquist, May, res. fel. Cornell Med. phys.
Bosworth, E. B., asst. biol. Yale. emb.
Boughton, Esther M., Mt. Holyoke. emb.
Bowers, W. B., Harvard. bot.
Bradley, Mary A., jr. nematologist. Dept. Agr. zool.
Brown, D. E., instr. biol. New York. zool
Butler, Elizabeth, Vassar. zool.
Chase, Jr., A. M., asst. biol. Amherst. emb.
Chen, N. S., Pennsylvania. emb.
Clarke, R. W., instr. phys. New York. phys.
Cline, Elsie, Johns Hopkins University. zool.
Cloudman, A. M., instr. biol. Vermont. zool.
Crane, N. F., Bowdoin. emb.
Curtis, Mary E., asst. biol. Wilson emb.
Dalton, A. J., Wesleyan. emb.
Davidson, Margaret, North Carolina College, emb.
De Bone, Frances M., student. asst. anat. Pittsburg, prot.
Deichmann, Elizabeth, Radcliffe. emb.
Delure, G. H., fel. Louvain, Belgium, phys.
Dettmer, Clara R., Columbia. prot.
Downey, H. R., Johns Hopkins Med. phys.
Drumtra, Elizabeth, Wilson. zool.
Dunbar, F. F., Harvard. bot.
Elftman, H. O., asst. zool. Columbia. zool.
Elis, Marjorie F., asst. zool. Dalhousie. zool.
Ferris, Frances R., asst. zool. Washington (Mo.) zool.
Fletcher, Lydia M., grad. Brown. emb.
Fort, Irene, Pennsylvania. bot.
Frame, Elizabeth G., Dalhousie. zool.
Frank, R. L., Cornell Med. phys.
Furtos, Norma C., asst. biol. Western Reserve. zool.
Goodloe, Sara, Goucher. proto.
Gregg, W. I., Harvard. zool.
Gregory, P. W., Harvard. zool.
Grizzle, Lucile A., teacher biol. Los Angeles H. S. emb.
Hall, E. K., asst. zool. Yale. zool.
Hamilton, Sally, Elmira. emb.
Hammond, J. W., Cambridge, Mass. phys. lect.
Hampel, C. W., Wesleyan. zool.
Hardesty, Mary, fellow biol. Newcomb emb.
Hare, Laura, De Pauw. zool.
Henderson, J. T., lecturer. McGill. phys.
Herskowitz, I. A., Columbia. emb.
Hetherington, W. A., asst. zool. Columbia. prot.
Hiller, S., Cracow (Poland) zool.
Hiraiwa, Y. K., grad. Chicago. emb.
Holliday, G. H., teacher biol. West Va. H. S. prot.
Hollinshead, W. H., instr. biol. Vanderbilt. emb.
Hopkins, S. H., William and Mary. zool.
Hoppaugh, Katherine W., Arizona. bot.
Howland, Esther, grad. Columbia. phys.
Hubbard, Catherine E., teacher Hartford H. S. proto.
Husted, Clara M., grad. Rochester. zool.
Husted, D. L., Oberlin. bot.
Jansen, J. B., prosector of anat. University of Oslo (Norway) emb.
Jewett, Frances L., Wellesley. bot.
Johnson, P. E., Amherst. zool.
Keith, Bernice, Nebraska. bot.
Kerrigan, Alice M., instr. biol. Boston T. C. zool.

Lane, Elinor M., asst. biol. Goucher. zool.
Leonard, S. L., Rutgers. zool.
Lichtman, Frieda, New York. emb.
Light, Jr., F. W. Johns Hopkins. phys.
Lovell, H. B., Harvard. zool.
Luce, W. M., Illinois. emb.
Martin, S. J., res. asst. Wisconsin. zool.
Martinovitch, P. N., grad Syracuse. zool.
McClintock, Barbara, instr. bot. Cornell. bot.
McClure, G. Y., Dartmouth. zool.
McClure, Katherine L., instr. biol. Morningside ((Ia.) zool.
MacCoy, C. V., Harvard. zool.
MacFarlane, Constance, Dalhousie. bot.
McGoun, Jr., R. C., asst. biol. Amherst. emb.
McInerney, Katheryn M., Tufts. zool.
McNutt, Dorothea. Wesleyan (Ill.) zool.
Miller, Ruth A., Bryn Mawr. emb.
Millikin, Eleanor, Wellesley. zool.
Molina, Ana M., teacher biol. Porto Rico. zool.
Morris, Helen S., grad. Columbia. prot.
Nabrit, S. M., instr. zool. Morehouse (Ga.) emb.
Naylor, Ernst, instr. bot. Missouri. bot.
Nelson, G. E., instr. biol. C. C. N. Y.
Newcomer, A. Virginia, Goucher. zool.
Newton, M. Isabel, asst. phys. Mt. Holyoke. phys.
Olcott, C. T., instr. path. Cornell Med. phys.
Pankratz, D. S., instr. biol. Kansas. phys.
Parpart, A. K., instr. biol. Amherst. phys.
Parsons, Elizabeth H., grad. Oberlin. emb.
Patrick, Ruth M., Coker (S. C.) bot.
Pfeifer, Katherine M., Washington. (Mo.) zool.
Pickett, W. N., Wabash. zool.
Pinsdorf, Kate, Smith. bot.
Prefontaine, G. H., asst. biol. Montreal. zool.
Pyle, Theresa P., Smith. bot.
Reck, Virginia D., asst. biol. Yale. zool.
Richter, Marion C. R., Columbia. prot.
Roberston, G. M., instr. biol. Dartmouth. prot.
Rowell, L. S., instr. biol. Vermont. emb.
Schmidt, L. M., instr. biol. Tufts. zool.
Scott, Julian P., Kodaker. O. M. 6.
Shields, M. L., instr. biol. Phillips Acad. (Mass.) prot.
Shinar, Catherine, Hunter. zool.
Shorey, Dorothy C., Radcliffe. zool.
Small, Virginia, Butler (Ind.) zool.
Smelser, G. K., Earlham (Ind.) zool.
Snell, G. D., grad. Harvard. zool.
Stabler, R. M., Swarthmore. zool.
Steele, C. W., Missouri. phys.
Stehr, W. C., asst. zool. Minnesota. zool.
Sun, T. P., Rockefeller Foundation. zool.
Te Winkle, Helen M., asst. zool. Oberlin. phys.
Tracy, Barbara, Connecticut. emb.
Turnbull, Virginia E., teacher Dorchester H. S. for Girls. zool.
Turner, Edna M., asst. biol. New York. phys.
Uhlenhuthe, E., assoc. prof. anat. Maryland. phys.
Van Rhyn, Elsie A., instr. biol. Porto Rico. prot.
Waterman, A. J., asst. biol. Western Reserve. emb.
Wells, Evelyn C., Tennessee. bot.
Wen, I. C., fel. Rockefeller Foundation. emb.
Wilde, Frances M., Radcliffe. zool.
Woodard, Jr., T. M., instr. biol. Vanderbilt. emb.
Woodruff, L. R., prof. zool. Yale. Br.
Wu, C. F., asst. biol. Wisconsin. prot.
Zimmer, Dorothy K., grad. Columbia. proto.
Zimmermann, Helen R., teacher Massachusetts H. S. bot.

ADMINISTRATION

MacNaught, F. M., business manager.
Crowell, Polly L., asst. to the business manager.
Chamberlain, Thelma I., secretary.
MacNaught, Jeanette, office asst.
Grizzle, Helen, secretary.

LIBRARY

Montgomery, Mrs. T. H. Jr., librarian.
Underwood, Katharine, asst. librarian.
Lawrence, Deborah, secretary.
Chase, Hazel, typist.
Rohan, Mary, file clerk.
Lyman, Marvis, file clerk.

NATIONAL RESEARCH COUNCIL

Crocker, W., div. biol. and agr.
Elliot, Edith L., sec. Board Nat. Res. Fellowships, biol. sciences.
Thorne, Louise C., Sec. to Dr. Cole.

CHEMICAL SUPPLY ROOM

Strong, O. S., assoc. prof. neur., Columbia, Director.
Wolff, W. A., grad. chem. Penn., asst. Director.
Hoss, Dorothea, stud. Holyoke.
Hale, Joseph, stud. Oberlin.
Holbert, Pauline, stud. Elmira.
Kril, Elsa, stud. Elmira.
Mast, Louise, stud. Roland Park.
McKeel, Evelyn, stud. Holyoke.
Spivack, Betty, stud. Hunter.
Zimmerman, Auerill, chem. and bact. Toledo Hospital.
Richard, Oscar, grad. phys. Harvard.

MECHANICAL DEPT.

Larkin, T., supt.
Khaler, R., asst.
MacBeth, B. J., night operator
Steele, N., fireman

BUILDINGS AND GROUNDS

Hilton, H. A., supt. buildings and grounds.
Hemenway, W., carpenter.
Bisco, A. H., storekeeper and head janitor.
Russel, R. L., gardner.
Russel, M. R., night watchman.

SUPPLY DEPARTMENT

Gray, G. M., Curator.
Veeder, J. J., Captain.
Lewis, E. M., Engineer.
Leathers, A. W., Head of shipping department.
Hilton, A. M., Collector.
McInnis, Jr., Collector.
Godrich, J., Collector.
Conklin, P., Fireman.
Lehy, J., Collector and chauffeur.
McAfee, Cora J., Secretary.
Crowell, Ruth S., Secretary.
Luce, H. N., Fish trap man.
Lillie, W., Deckhand.
Parrish, J., Collector.
Sensenig, H. R., Collector.
Alsever, J., Collector.
Whitelaw, R. N. S., Collector.
Hobbs, K., Collector.
Yeomans, A., Collector.
Mason, W. V., Collector.
Ballard, F. J., Deckhand.
Gray, I. E., Curator's assistant; Assistant professor of Zoology Tulane University, New Orleans, La.
Wamsley, S. W., Special preparator; Supervisor of Schools, Charleston, S. C.

BUREAU OF FISHERIES

Fisheries Biological Laboratory
U. S. Department of Commerce

Higgins, E., chief div. of scientific inquiry, U. S. B. of F., Director.
Bateman, C. B., technician, U. S. Dept. Agr.
Buhrer, Edna M., jr. nematologist, U. S. Dept. Agr.
Christie, J. R., assoc. nematologist, U. S. Dept. Agr.
Cobb, N. A., nematologist, U. S. Dept. Agr.
Cobb, A., lab. aid, U. S. Dept. Agr.
Cohen, B., chem., U. S. Hygienic Laboratory.
Cole, A. E., asst. prof. biol., Northwestern.
Conger, P. S., diatomist, asst. Carnegie Institution.
Ford, Regina M., asst. librarian, U. S. B. of F. Washington.
Fries, E. F. B., fel. zool., Harvard. Investigator.
Galtsoff, Eugenia, lab. aid.
Gates, G. E., prof. biol. Judson (Burma).
Gee, H., Yale.
Glancy, J. B., asst. biochem. Pease Lab. (N. Y.)
Hall, F. G., prof. biol. Duke.
Heinly, Helen M., jr. nematologist, U. S. Dept. Agr.
Hemmeter, J. C., physician, Baltimore.
Hill, S. E., fel. biol. Princeton, res. worker.
LeHew, A. E., temporary asst. U. S. B. of F.
Lepkovsky, S., bio. chem. Wisconsin.
Lewis, F. P., Buffalo.
Linton, E., res. fel. Pennsylvania.
MacCallum, G. A., parasitologist, Baltimore.
McCarthy, Hallie M., U. S. B. of F., Sec. to the Director.
Nesbit, R. N., jr. aquatic biol., U. S. B. of F.
O'Brien W., director, Boston Aquarium, Boston.
Pease, H. B., tech. Pease Lab. (N. Y.)
Pearse, R. L., temporary asst. U. S. B. of F.
Pearson, J. C., temporary asst. U. S. B. of F.
Perkins, E. B., temporary asst. U. S. B. of F.
Power, Gertrude L., jr. scientific aid U. S. Dept. of Agr.
Scheidt, C., temporary asst. U. S. B. of F.
Sette, O. E., Chief, Division of Fishery Industries, U. S. B. of F.
Smith, H. M., Director of Fisheries, Bangkok, Siam.
Talavera, F., Pensionada, Philipine Government.
Wheeler, P. H., temporary asst. U. S. B. of F.
Wilson, C. B., Head Science Dept. Mass State Normal School.

BUS SCHEDULE

WOODS HOLE, FALMOUTH & FALMOUTH HEIGHTS—SUMMER SCHEDULE

In Effect June 15 to September 1, 1927, inclusive.

Rates Between—Woods Hole and Falmouth, 25c; Woods Hole and Quissett, 20c; Woods Hole and Falmouth Heights, 40c; Quissett and Falmouth, 20c; Falmouth and Falmouth Heights, 20c.
Children under 12 years of age, half fare.
Children, under 12 years, Woods Hole and Falmouth, round trip, 25c.
10 Trip Ticket, Woods Hole and Falmouth, $2.00 (Adults Only).

Schedule Week Days
(Daylight Saving Time)

Leave	A. M.			P. M.						
Woods Hole,	8.25	10.15	11.20	1.35	2.45	3.55	5.00	7.15	8.15	10.10
Due										
Falmouth	8.45	10.30	11.40	1.55	3.05	4.20	5.20	7.35	8.35	10.25
Fal. Heights	8.55	10.40	11.50	2.05	3.15	....	5.30	....	....	....

Leave	A. M.			P. M.						
Fal. Heights	9.00	10.40	11.50	2.05	3.15	....	5.30	....	....	....
Falmouth (E. Theatre)	9.15	10.50	12.00	2.15	3.25	4.20	5.40	7.45	9.30	10.30
Due										
Woods Hole	9.35	11.10	12.20	2.35	3.45	4.40	6.00	8.05	9.50	10.50

SCHEDULE—SUNDAYS ONLY
(Daylight Saving Time)

	A. M.				P. M.		
Leave Woods Hole P. O.	8.20	10.10	11.20	....	3.00	4.30	6.00
Leave Fal. (E. Theatre)	8.60	10.25	11.35	12.05	3.20	4.50	6.20
Due Fal. Hegihts P. O.	8.50	10.35	11.45	12.15	3.30	5.00	6.30

	A. M.				P. M.		
Leave Fal. Heights P. O.	8.55	10.40	11.45	12.15	3.35	5.05	6.35
Leave Falmouth (E. Theatre)	9.05	10.50	11.55	12.25	3.45	5.15	6.45
Due Woods Hole	9.25	11.10	....	12.45	4.05	5.35	7.05

SCHEDULE—SATURDAY EVENINGS ONLY

	P. M.			
Leave Woods Hole	6.45	7.45	9.30	10.15
Leave Falmouth (E. Theatre)	7.15	9.00	9.45	10.30

Positively no errands done between June 20 and Sept. 1 except banking.

Bus connects with boats: 9.40, 10.15 a. m., 3.50, 4.45, 7.00 p. m.

TRAIN SCHEDULE

DAYLIGHT SAVING TIME

Woods Hole to Boston—Week Days

	A.M.	A.M.	A.M.	P.M.	P.M.
Woods Hole,	6.30	7.15	10.25	2.05	5.05
Falmouth,	6.37	7.22	10.32	2.13	5.13
Boston,	9.00	9.20	12.30	4.35	7.17

Boston to Woods Hole—Week Days

	A.M.s	A.M.	A.M.	P.M.s	P.M.	P.M.†	P.M.	P.M.s
Boston,	....	7.15	8.30	1.06	1.12	4.03	4.27	8.30
Falmouth	7.37	9.23	10.53	3.08	3.23	6.01	6.32	10.57
Woods Hole,	7.45	9.30	11.00	3.15	3.30	6.08	6.40	11.05

SUNDAY TRAINS

	To Boston Read Down					From Boston Read Up	
	A.M.	P.M.	P.M.	P.M.	P.M*.		
Woods Hole,	9.15	4.35	5.05	6.00	9.00	9.30	11.00
Falmouth,	9.23	4.42	5.13	6.07	9.08	9.23	10.53
Boston,	....	6.35	7.17	8.13	11.20	7.15	8.30
						A.M.	A.M.

THE "CAPE CODDER"

June 26 to Sept. 11 inclusive. (Sleeping cars only.)

Fridays Only		Sundays Only	
New York (G.C.T.)	11.20 P.M.	Woods Hole	9.00 P.M.
125th Street	11.30 P.M.	125th Street	5.19 A.M.
Woods Hole	7.45 A.M.	New York (G.C.T.)	5.30 A.M.

†Will not run Sept. 5.
sSaturdays only.
*Runs Monday, Sept. 5, instead of Sunday, Sept. 4.

WHAT'S WHAT In Woods Hole

Telegraph Office Hours

Daylight Time

Week Days .... 8.30 a.m. to 8.00 p.m.
Sundays .... 10.00 a.m. to 11.00 a.m.
6.30 p.m. to 7.00 p.m.
Holidays .... 8.00 a.m. to 12.00 a.m.
4.00 p.m. to 8.00 p.m.

Post Office Hours

Daylight Time

Mails Due .... 9.30 a.m.
" " .... 3.30 p.m.
" " .... 6.40 p.m.

Mails Close .... 6.45 a.m.
" " .... 9.55 a.m.
" " .... 4.35 p.m.

Office Hours ...... 7.00 a.m. to 7.50 p.m.
No Mails on Sunday

Library Hours

Daylight Time

Wednesdays and Saturdays
3.00 p.m. to 5.00 p.m.
7.00 p.m. to 8.00 p.m.

NEW BEDFORD, MARTHAS VINEYARD & NANTUCKET STEAMBOAT LINE

Time Shown Below is Daylight Saving Time
Summer Schedule

In effect June 12, 1927

Week Days

Leave	A.M.	A.M.	P.M.	P.M.
N. Bedford,	8.10	9.45	2.30	5.30
Woods Hole	9.40	11.15	3.50	7.00
Oak Bluffs,	10.40	12.00	4.40	8.10
Due V. Haven	....	12.50	....	7.45
Due Edgart'n	....	....	....	9.00
Due Nantucket	1.15	....	7.15	....

Sundays

Leave	A.M.
New Bedford	8.45
Woods Hole,	10.05
Oak Bluffs,	10.55
Due Nantucket,	1.15

Week Days

Leave	A.M.	A.M.	P.M.	P.M.
Nantucket	....	7.00	....	1.30
Edgartown	5.00	....	....	....
Oak Bluffs,	5.40	9.15	12.05	4.00
V. Haven,	6.10	....	12.55	....
Woods Hole	6.55	10.55	1.40	4.45
Due N Bedf'd	8.35	11.50	3.20	6.25
			P.M.	P.M.

Sundays

Leave	P.M.
Nantucket,	1.30
Oak Bluffs,	3.25
Woods Hole	4.25
Due New Bedford	6.00

W. A. SMITH. General Agent.

SCHOLARSHIP FUND TO GET BIG BOOST

Leonard B. Clark, the famous sailor and navigator, wants to buy a car. Robert Cushman, proprietor of the Crocker Garage, expert mechanic and *salesman*, wants to sell a car. *The Collecting Net* wants Mr. Clark to buy the car from the Crocker Garage because *Mr. Cushman has promised to donate the sum of ten dollars* to the "C. N. Scholarship Fund" if the navigator can be inveigled into buying it.

The contraption in question is a Ford Coupe, a relic of former ages, and it has been rumored that it was a dilapidated, second-hand car when Leonardo de Vinci bought it from Lorenzo de Medici. Mr. Cushman is demanding the exorbitant sum of $35.00 for this self-propelling (usually) junk heap. The tires are old, the wind shield is a network of cracks, and the mud-guards are hardly recognizable as such. The top would serve as a sieve although the holes are so close together that in some places they fuse to form a larger hole. The upholstery has been largely replaced by layers of dirt. It is thought that geologists could glean valuable information of prehistoric times by examining its many and varied layers. An enormous amount of energy and time was expended in trying to start the car when Mr. Clark wanted a demonstration. It simply would not go. (It seems that when one is paying $35.00 for a car one should not expect it to run all the time without any gasoline in the tank—we mean it is not reasonable!)

On going to press it has been learned that Mr. Clark will probably become affiliated with the "car". The suspense is almost unbearable — we tremble lest Mr. Clark realize that Mr. Cushman, who is a very busy man, has only found time to fix up the external features of this peculiar antique.

DR. HEILBRUNN GIVES LECTURE

(Continued from Page 1)

is to say, whether it is quite fluid or relatively viscous. Often enough physiologists assume that protoplasm is a stiff jelly, but just as often other physiologists base conclusions on the idea that it is a fairly mobile fluid. As a matter of fact it may be both, not only in different cells, but even in the same cell at different times. There is only one way to decide how fluid or how viscous protoplasm is, and that is by suitable measurement. Within the last few years such measurements have been made both for plant and animal cells."

The first determinations were made by the German botanist Heilbrunn, who watched starch grains fall through the protoplasm of bean cells. Later, he pulled iron specks through the protoplasm with an electro-magnet. More recently, Seifriz used particles of nickel, instead of iron, for iron no doubt has an adverse specific effect due to its solution. Prof. Heilbrunn's method avoids the consequences of the presence of foreign substances, by simply applying centrifugal force and using the well known formula of Sir Frederick Stokes to calculate the viscosity of the medium (protoplasm) from the amount of motion of its granules and the known constants of the experiment. Stokes' law is based on certain assumptions — the particles must be spheres, isolated and falling freely in a homogeneous medium. Here the spheres are in rather close proximity, and a correction, as Prof. Heilbrunn showed, must be introduced to allow for their mutual interaction (Cunningham's correction formula). The medium is not strictly homogeneous: but with particles of this size he assumes it to be. With particles the size of granules in sea-urchin eggs, this may not cause material error. We must, however, remember that with very tiny particles, even the air itself is not homogeneous; and Prof. Robert A. Millikan had to work out and introduce a correction factor for atmospheric inhomogenity into Stokes' equation, when he applied it to measuring the extra weight acquired by an ultramicroscopic oil droplet when it captured a single electron. This work won Millikan the Nobel Prize.

The work of Heilbrunn and his colleagues shows that the viscosity of protoplasm varies from about a few times that of water to that of a weak jelly. Heilbrunn has checked his results by observing the time it takes for Brownian movement to re-distribute the granules once more, and applying Einstein's formula for Brownian motion. And by applying the formulae of Einstein, Hatschek, and Bingham, the viscosity of the entire protoplasm (granules and intergranular material), in several times that of the intergranular medium. "Protoplasm, in some cases at least, is far from being a highly viscous fluid." Contrasting the behavior of gelatin and metal sols with respect to their sensitiveness to salts, Heilbrunn said: "Protoplasm is a suspension and it behaves like one." By a consideration of the behavior of protoplasm towards ions of various charges, the conclusion is reached "that protoplasm is a positively charged suspension which may be quite fluid in some cells. How is this fluid suspension prevented from scattering out through the surrounding medium? Obviously there must be a fairly rigid membrane to enclose it, a membrane rigid enough to resist the impact of granules shot against it by cen-

(Continued on Page 10)

M. B. L. SATURDAY EVENING DANCE

The first Saturday evening dance given by the M. B. L. Club will be held tonight, July 9, from ninetill twelve o'clock, on the main floor of the Club house. Jerry Bowes orchestra will play and there will be a specially waxed floor. The dance will be free to members of the club and a fee of .75 will be charged non-members.

It is planned that this dance will be the first of a series of Saturday evening orchestra dances at the Club. These plans will be carried out on condition that students taking the courses, and research workers, will respond to the urgent appeal for Club funds by paying the annual $1.50 dues. This may be paid at Mr. MasNaught's office or at the door of the Club house on the evening of the dance.

All club dances will be free to club members. Non-members will pay .75 per dance.

DR. HEILBRUNN GIVES LECTURE

(Continued from Page 9)

trifugal force. The surface membrane of a cell is an osmotic membrane and for this reason alone, if for no other, we are interested in understanding its physical properties."

Dr. Heilbrunn considers the usual notion advanced in t.xtbooks, that the membrane results from a surface accumulation of substances which lower surface tension (Gibbs' rule), as an "absurd idea on the face of it, for in order to have materials accumulate in a surface film it is necessary to have a surface film, and it is hard to imagine a surface film between two watery solutions which, as far as the theory goes, are perfectly miscible. There are various other arguments which might be cited against this universally accepted theory." By a consideration of the behavior of torn protoplasm in marine eggs and in Protoza. He shows that membrane formation resembles blood coagulation. "If calcium and pigment granules unite to form ovothrombin, why do they not unite within the cell and form a coagulation there? As a provisional hypothesis to explain this point, let us assume that calcium within the cell is for the most part not free but bound up in some loose combination with lipoid. This hypothesis is very possibly wrong, but it has the advantage that it can be very readily tested." Fat solvents cause a breakdown of pigment granules and formation of numerous vacuoles within the cytoplasm of sea-urchin eggs, and long exposure to isotonic calcium solutions, causes cytolysis. These results agree with the theory.

"If our hypothesis is correct it will, beyond any question, contribute to the solution of one of the most important problems in the colloid chemistry of the cell. Bacteria, protoza, tissue cells of higher animals, blood cells, are all known to undergo a mysterious transformation which has been called a wide variety of names by the many, many workers who have studied it. In cytolysis, hemolysis, or 'tropfische Entmischung', or cloudy swelling, the cell frequently becomes pale as a result of a loss of pigment. Generally it becomes filled with tiny droplets or vacuoles. In the sea-urchin egg, if our interpretation is correct, cytolysis is due to the freeing of calcium within the egg interior. The free calcium unites with the pigment granules, possibly with the pigment itself, ovothrombin is formed, and immediately a surface precipitation reaction is initiated throughout the cell. This is evidenced by the formation of numerous partitions or films within the cell so that it appears to be made up of a mass of vacuoles. In studying the colloid chemistry of protoplasm we must be on the lookout for reactions comparable to the internal surface precipitation reaction as I have described it."

Your reviewer might point out that many influences may bring about gelatinization of the intergranular protoplasmic fluid which jelling may be partial in degrees or in extent; and following this, there may be differential diffusions leading to marked local differences in ion concentrations, notably in pH. For gelitinization brings with it a practical inhibition of the thorough mixing due to kinetic motion in the fluid. Thus if we prepare an agar jelly containing a little potassium ferrocyanide and some phenolpthalein with enough alkali to render the whole pink, and then layer over the set jelly some ferric chloride, for example, we soon see a white band appear and spread down the tube, followed by a more slowly advancing blue band. Hydrolysis and differential diffsion form sizable layers within a few seconds.

Among the many other interesting facts brought out by Dr. Heilbrunn is the viscosity-temperature curve of the egg of the clam *Cumingia*, which shows a peculiar maximum at about 15° C. and also another near the freezing point, and one at 30° C. "There is no known inanimate colloid that behaves like this . . . Protoplasm is not gelatin, nor egg albumin, nor casein. Its behavior is not like that of any of these substances."

This is certainly true. Perhaps the peculiarities mentioned will find their explanation when we experimentally determine the behavior of *mixtures* of two or more relatively simple colloids, as has been done by Dr. D. T. MacDougal of the Desert Laboratory at Tuscon, Arizona. Prof. H. Schade of Keil has also pointed out the peculiar results of "entgegengesetzte Quellung", where two colloidal groups co-exist and respond at different rate to changes in H-ion concentration and the like. The remark of the French philosopher Rousseau "Man is good, but men are wicked", seems to apply to colloids as well.

"As we learn more about what protoplasm is like, we may be able to study the physical properties of colloidal systems which really resemble it in their fundamental nature. Such study will doubtless suggest new methods of attack on the living substance itself. In the years ahead, biologists may hope to penetrate the mysteries of the living cell with at least as much success as the physicists have had in penetrating the mysteries of the atom.

Jerome Alexander.

Evolution of the Chemical Room

(Continued from Page 1)

"Cogito ergo sum"—perhaps in this case better "Appellatus ergo sum"—has proven untrue, at least in the case of the writer who has not noticed any increase in his limited store of chemical lore since he has been dubbed "Chemist". Professor Hunter was succeeded in this office by the writer in 1905, possibly 1906, there being some doubt about the date. At the time when the present incumbent assumed this office the Chemical Room occupied a portion of the second floor of the middle part of the Old Main Building, now occupied by the class in Protozoology. This portion was a part of the west side of this room, the remainder being occupied by the Library and two investigators' rooms at the north end. The Chemical Room itself was thus about fifteen to twenty feet long by about twelve feet wide. This generous space was further increased by a loft directly above, access to which was gained by a somewhat perilous and acrobatic ascent by means of very steep movable steps. At this primitive period the chemical activities of the Chemist consisted mainly in mixing such time honored compounds as Fleming's, Kleinenberg's, Perenyi's and other similar fluids. We were not troubled then with molecular weight solutions, buffers and other various standardized solutions, all against a shifting, chaotic background of ions, electrolytes, etc., with a number of dubious new elements thrown in to increase the confusion. Even at this early period the necessity of protection against the withdrawal of undue amounts of expensive reagents was exemplified by the following incident, of perhaps doubtful authenticity: an investigator ordered a solution of osmic acid. When asked what strength, he said, "Oh, about ten per cent", and when asked the amount he said "About two quarts"!

On his induction in his official duties the Chemist was solemnly presented by the Director (Dr. F. R. Lillie) with a volume entitled "Memoranda, M. B. L., 1904, F. R. L.. Inventory Sept. 26 1904". This volume was about 7x4", very slightly larger than our present order books. In this we find some eight or nine pages devoted to an inventory of the "main storeroom". It might be of interest to give a brief summary of its items in the order in which they occur. The undying thirst for finger bowls was even then manifested by the presence of 841 of them; Coplin jars, 259; alcohol lamps, 106; Naples jars, 458; balsam bottles, 125; empty glass stoppered bottles of various sizes, about 750; alcohol bottles, 319; bottles with special reagents exclusive of stock bottles, 240; battery jars of various sizes, 24; aquarium jars, round, 18, "and 31 of various sizes in loft"; crystalization dishes, about 125; square glass trays, 82; glass funnels, 30; mortars, 4; graduated cylinders, including "4 over old iron stairway", 68; Syracuse watch glasses (even then well represented), 693; hones, 5; Petri dishes, 81; Tralle hydrometer for spirit, 1; Beaumé specific gravity scales, 4; centigrade thermometers, 28; graduated pipettes, 44; ungraduated pipettes, 11; various sizes of beakers, 149; Erlenmeyer flasks, 136; wash bottles, 27; Jena flasks, 9; stender dishes, 63; test tube stands, 30; shovels, 36; pails, 14; siphon tubes, 6; small paraffin baths, 17; bell jars, 5; square aquarium jars, 5; paraffin filter, 1; iron tripods 19; stock bottles, 28; nappies, 126. This, however, does not apparently include the total laboratory equipment for we find some fifteen or sixteen pages devoted to various items headed "Phys. Shipment—3639" and covering about five pages, the remaining ten being headed "General Supplies" with numbers apparently representing orders. If we pick out the chemical items they reach the staggering total of over 100, the remainder being devoted to miscellaneous laboratory supplies. We find also a heading "Phys. Store-room" with no inventory indicated. It is to be suspected however, that even at that early date the physiologists had begun their nefarious activities and absorbed those fifteen pages of supplies.

(Continued Next Week)

OUR AUTHORiteS

Dr. Edwin G. Conklin is professor of zoology at Princeton University and a member of the National Academy of Sciences.

Dr. Conklin came down to Woods Hole first in 1890, and with the exception of three or four summers spent in Europe, he has been with us constantly. During the summers of 1890-91 he occupied the Johns Hopkins University Table at the Bureau of Fisheries, and also did some work over at the Marine Biological Laboratory. His studies were then devoted to the embryology of *Crepidula*—and he has been carrying on investigations in this field almost ever since.

Dr. Oliver S. Strong is professor of neurology and neurohistology at the College of Physicians and Surgeons, Columbia University. Dr. Strong's initial visit to Woods Hole was in the summer of 1892. With the exception of the summers of 1900 and 1902 he has not missed a year out of the thirty-six years. During the years from 1895-1901, inclusive, Dr. Strong was associated with Dr. Frank R. Lillie in giving the course in embryology down this laboratory.

Wide Area Patrolled by Local Coast Guard

Recently, with the abolition of the Coast Guard Station at Nantucket, the Woods Hole base has taken over their work and now includes in its patrol area all the coastwise waters as far east as Monomoy Point (at the upward bend of the Cape) including Nantucket and the Vineyard. The present equipment consists of fifteen seventy-five foot patrol boats, three thirty-six foot pickets and one speed boat. It is particularly interesting to know that the last, the little grey fellow that attracts so much attention as it churns through the Hole is a converted rum runner that was found adrift, and was induced by the Coast Guard to abandon its nefarious ways and become a useful citizen of these waters. Besides these smaller craft there is the station ship, the Wyandotte. This vessel is replacing the familiar Acushnet which is now relieving a New York cutter, and will not be back in these waters until the Fall.

The personnel of the base comprises one hundred and sixty-two enlisted men, nineteen warrant officers and three commissioned officers, under the able command of Lieutenant R. L. Raney.

The chief duty of the Coast Guard is the patrolling of the coast waters to apprehend smugglers, a considerable task in this region where the coast is well indented and the many small inlets and creeks offer an opportunity for illicit traffic. Police duty is not their only task, however. The Coast Guard is frequently called upon to perform rescue work. In the past year the Woods Hole base alone has performed over eighty-five rescues, eight of them occurring withing a period of two weeks in January—a considerable record of service for so short a period. Besides the work of rescuing wrecked vessels by means of the patrol boats, there are the specialized life-saving crews stationed at Gay Head and Nantucket where continuous five mile patrols are maintained on shore to guard the safety of coastwise traffic.

Beach Tennis Courts to Be in Readiness Soon

Due to no fault on the part of the Courts Committee, the M. B. L. Tennis Club is not yet able to present its full complement of courts for play. The work of reconstruction on the three Beach Courts, which were to have been ready for active use early this Spring, has been unavoidably delayed and as a result the Mess Court is the only one at present functioning. It is hoped that in a very short time one of the Beach Courts (the East one) will be opened for play and that work will continue actively on the other two. To avoid undue crowding of the one court now in use complete cooperation is requested of the members in the matter of signing up for play.

Dr. R. Bennitt is treasurer again this season and announces that he is continually in a receptive frame of mind. He may be found in Room 25 of the Old Main Building, and should receive promptly the dues of all those who desire to make use of the M. B. L. courts. The dues to members of the M. B. L. are as usual $5.00 for the season and $4.00 for the six-weeks period of the courses. The rate to transients is $1.00 a week or fraction thereof. Junior membership (for those under 16) is $2.50.

In view of the crippled condition of the courts this year, it seems advisable to dispense with the annual tournament which has for so long been an outstanding feature of the Club's activities. Should any change in this policy become possible, due announcement of the fact will be made on the various bulletin-boards and through the columns of *The Collecting Net.*

THE COLLECTING NET

Volume II
Number 2

WOODS HOLE, MASS., SATURDAY, JULY 16, 1927

Subscription $1.00
Single Copies, 15c

BUREAU OF FISHERIES CONSERVATION WORK

Fish Commission Established by Congress in 1871

The United States Fish Commission was established by Congress in 1871 and Spencer Fullerton Baird was appointed the first Commissioner in the same year. Until 1903 the Commission was operated as an independent organization but at that time it was placed under the administration of the, then, Department of Commerce and Labor and the title was changed to the United States Bureau of Fisheries. The duties of the Commission were outlined by Prof. Baird in his report of 1872-73 in the following words which refer to the resolution of Congress establishing the Commission: "The resolution . . . directed that it should be the duty of the Commissioner to prosecute the necessary inquiries, with a view of ascertaining whether any and, if so, what diminution in the number of food-fishes of the coast and lakes of the United States had taken place; and to determine what were the causes of the same, and to suggest any measures that might serve to remedy the evil."

(Continued on Page 10)

Laboratory Activities

Tuesday, July 19
8.00 P. M.

Evening Lecture. Dr. Jacques Bronfenbrenner, Associate at Rockefeller Institute. **Subject:** "Studies in the Bacteriophage of d'Herelle" (provisional title). Motion pictures.

Friday, July 22
4.00-6.00 P. M.

Botany Tea.

8.00 P. M.

Evening Lecture. Dr. Frank R. Lillie, University of Chicago. **Subject:** "The Gene and the Autogenetic Process".

Saturday, July 23
9:00-12:00 P. M.

Club Dance. Orchestra. M. B. L. Club. Admission free to members; 75c for non-members.

Sunday, July 24
Beginning at Twilight

Informal Singing. Roof of Brick Building if the weather is good. Otherwise the group will gather upstairs on the M. B. L. Club porch.

Currents in the Hole

At following hours the current in the hole turns to run from Buzzards Bay to Vineyard Sound:

	A.M.	P.M.
July 15	5.00	5.15
July 16	6.00	6.15
July 17	7.00	7.15
July 18	8.00	8.15
July 19	8.30	9.00
July 20	9.20	10.00
July 21	10.05	11.00
July 22	11.10	11.45
July 23	11.50	12.00

In each case the current changes six hours later and runs from the Sound to the Bay.

The Prayer of Agassiz

BY JOHN GREENLEAF WHITTIER

On the isle of Penikese,
Ringed about by sapphire seas,
Fanned by breezes salt and cool,
Stood the Master with his school.
Over sails that not in vain
Wooed the west-wind's steady strain,
Line of coast that low and far
Stretched its undulating bar,
Wings aslant along the rim
Of the waves they stooped to skim,
Rock and isle and glistening bay,
Fell the beautiful white day.
Said the Master to the youth:
"We have come in search of truth,
Trying with uncertain key
Door by door of mystery;
We are reaching, through His laws,
To the garment-hem of Cause.

Him, the endless, unbegun,
The Unnamable, the One
Light of all our light the Source,
Life of life, and Force of force.
As with fingers of the blind,
We are groping here to find
What the hieroglyphics mean
Of the Unseen in the seen,
What the Thought which underlies
Nature's masking and disguise,
What it is that hides beneath
Blight and bloom and birth and death.
By past efforts unavailing,
Doubt and error, loss and failing,
Of our weakness made aware,
On the threshold of our task
Let us light and guidance ask,
Let us pause in silent prayer!"

(Continued on Page 3)

Laboratory At Penikese Fore Runner of M. B. L.

"THE STORY OF WOODS HOLE"

DR. EDWIN GRANT CONKLIN
Professor of Zoology, Princeton University

II. THE BEGINNING OF BIOLOGY AT WOODS HOLE.

1. The Coming of the Fish Commission

The history of Woods Hole as a biological center began in 1871, when Spencer F. Baird, Secretary of the Smithsonian Institution, was made the first Commissioner of the United States Fish Commission which had just been established by Act of Congress. Baird opened a laboratory in an old shed on the Lighthouse Board's wharf in Little Harbor in the summer of 1871. During the three following summers he conducted work at Eastport and Portland, Maine and at Naank, Connecticut, and in 1875 he again came back to Woods Hole where a laboratory was fitted up on the Government wharf in Little Harbor, of which Baird said in his "Report" (1876): "With the exception of the building erected by Professor Agassiz at Penikese it is the first permanent and formal sea coast laboratory, constructed and put into operation especially for the purpose, in the United States."

From 1877 to 1880 the work of the Fish Commission was carried on at Salem and Halifax, Gloucester, Provincetown, and Newport. After having tried out all of these places Baird decided that Woods Hole was the best place for the permanent laboratory of the Fish Commission. In his "Report" for 1882 he wrote: "After careful consideration of the subject the choice was found to lie between two stations, Woods Hole and Newport." The former was finally chosen because the sea water there was exceptionally pure, free from sediment or contamination with sewage, while there were strong tide currents and no large rivers to reduce the salinity of the water.

Baird undertook to enlist the cooperation of educational institutions and of other corporations and individuals in the establishment at Woods Hole of a national center of biological research, and to this end he proposed that the land for the sta-

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"The Chemical Room"

Its Past and Present

Dr. Oliver S. Strong

Professor of Neurology and Neuro-Histology, College of Physicians and Surgeons, Columbia University.

This is the second installment of Dr. Strong's article on the development of the Chemical Room.

In a year or two it was found that a larger space was required for the Chemical Room and new quarters were taken up in the basement of the middle part of the Old Main Building including the adjoining end of the north wing. These quarters were much more spacious than the old, but the height of the ceiling in places made tall persons practically ineligible as assistants. It may be remarked here that in 1907 the adjoining Dark Rooms for photography in the south wing, with their marvelous labyrinthine passages, were constructed under the direction of the Chemist, accompanied by the steadily increasing horror of the Director at the mounting expenses involved during construction. The basement Chemical Room had its mysteries too.

A certain gentleman, now an honored professor in one of our best known universities, was at that time engaged to a young lady residing in Woods Hole to whom he was soon to be married. One evening, on his way to discuss with his fiancée certain important details of their approaching wedding, he encountered a certain animal indigenous to Woods Hole with very disastrous results. The conversation had to be conducted at long range, and on his return he buried the discarded garments in that portion of the north wing forming a part of the Chemical Room, this part at that time having no floor. Later the victim, thinking the process of deodorization was completed, requested another member of the Laboratory to exhume the aforesaid garments and send them to him. The dirt floor of this part of the Chemical Room, after the receipt of this request, resembled a newly ploughed garden; but owing to some mistake in directions the garments were never found.

It was during this sojourn in the basement that the Chemical Room discarded the loose slips of paper on which orders were made and which soon found their way into the wastebasket and substituted the present order books which have been blessed (?) by investigators ever since. This was the suggestion, as the Chemist remembers it, of Shiro Tashiro who was then acting as assistant in the Chemical Room and beginning there his now famous researches on the evolution of carbon dioxide in neural and other forms of vital activity.

Move to Crane Building

During the whole sojourn in the basement the Chemical Room steadily expanded and was very much crowded when finally transferred in 1914 to the south side of the basement in the new brick building donated by Charles R. Crane and opened for the first time that season. At that time the eastern end of the basement, the part now with a wooden floor and some other adjoining rooms on the south end, were occupied by Mr. and Mrs. Bisco.

Before, however, this transfer was made an important innovation was introduced by the Chemist. This consisted in the appointment of a member of the gentler sex as one of the assistants in the Chemical Room, Miss Dawson. The Chemist well remembers the trepidation of the Director when this innovation was suggested to him. Quite recently the Chemist reminded the Director of this incident, pointing out the brilliant success of this innovation and the Director very gracefully explained his trepidation as due to fear for the safety of the bachelor Chemist.

The expansion of the Chemical Room and the consequent desire for more space was by no means checked in the new quarters and soon longing eyes were cast upon Mr. Bisco's apartment which was not really well adapted for residential purposes. Consequently in 1918 what was known as the old red Kidder Cottage was moved to its present location and occupied by Mr. Bisco and his former apartment was absorbed by the Chemical Room. Expansion continued and in 1925 the Chemical Room added to its quarters the fine additional room contained in the new building opened then. The Chemist well remembers the bland suggestion of the Director that with this large addition the Bisco part would no longer be needed, but this suggestion was firmly, fortunately, opposed by the Chemist. The Director in turn accused the Chemist of casting longing eyes, when looking over the plans, at the space allotted to the present machine room across the hall. It looks at present as though the triumphant march of the Chemical Room in this direction has been checked.

Statistics Show Growth

It might be well at this point to indulge in some dry statistics and glance at some figures of expenditures culled from the Treasurer's Reports from 1888 to 1910. Owing to the way

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APPARATUS ROOMS ENTAIL MUCH CARE

Precision and fragile apparatus owned by the Marine Biological Laboratory has been set aside in special rooms and cases in charge of a custodian. This group includes a fairly extensive equipment of physical and physico-chemical instruments which are kept in adjustment and repair especially for research. The stock is indexed, and a list arranged alphabetically for reference will be found in the apparatus rooms office, room 216, Brick Laboratory. Excepting certain instruments of precision which are permanently reserved for comparison and calibration the apparatus is accesible for short loans, but it is desired that this equipment shall be generally available and that its use shall not be restricted to a small number of persons. It is requested, therefore, that investigators who could not provide themselves with special apparatus plan their work so as to make the best use of the more expensive and delicate instruments, by permitting for some rotation or interchange with others. Where this is impracticable the Laboratory will endeavor to provide the necessary equipment but will in such cases charge a moderate fee for its use.

Applications for use of the special apparatus may be made through Mr. B. M. Duggar, Jr. in the Apparatus Rooms office during weekdays, 9 to 12 a. m. Advance requests which have been received in connection with the Application for Research Accommodations are on file and instruments will be supplied where possible in accordance with these notifications.

Reference to the general policy and working arrangement of the Department of Chemical Supplies and Scientific Apparatus will be found in the Annual Announcement, 1927, pages 34 to 36, together with instructions concerning certain special equipment. It will be of advantage to those desiring the use of apparatus to reread this section in the Announcement.

Those who are strangers about the Laboratory buildings and who are unacquainted with the general plan of distributing the special apparatus, may find the following statements concerning the location of the more permanent general apparatus, and the information regarding associated matters of value and interest.

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"The Story of Woods Hole"

(Continued from Page 1)

tion be purchased by such institutions, corporations, and persons and presented to the Government for this purpose. Accordingly the land and shore line on which the buildings and wharves of the Bureau of Fisheries now stand was bought of Isaiah Spindle for $7,250, and presented to the Government, this sum being contributed by the following donors:—

The Old Colony R. R. Co.	$2500
Johns Hopkins University	1000
Princeton University	1000
Williams College	500
Alexander Agassiz	500
John M. Forbes	1000
Isaiah Spindle & Co.	500
Mrs. Robert L. Stuart	250

Mr. Joseph S. Fay donated the tract of land along the shore between the present Coast Guard wharf and the entrance to Penzance.

Mr. Agassiz for Harvard University and the other colleges and universities named made their contributions "with the understanding that, as far as possible they were each to be allowed to send one specialist to the station for the purpose of carrying on scientific work." (Fish Commission Report 1883). This explains the fact that each of these institutions has the privilege of appointing a representative to a table at the Fisheries Bureau. When on one occasion this privilege was denied by the Commissioner of Fisheries Mr. Agassiz fought this decision and won his case.

Thus the Fish Commission Laboratory was permanently established at Woods Hole in 1881, the land belonging to the present Fisheries Bureau was acquired, and in the following year the present Laboratory was built. In 1886 the "Residence" was constructed and there Baird died in the summer of 1887.

2. The Agassiz Laboratory at Penikese.

While Woods Hole was thus selected as the permanent station of the United States Fish Commission another laboratory, short-lived but of great influence, was established by Louis Agassiz on Penikese, one of the Elizabeth Islands, only fifteen miles distant from Woods Hole. This small island about two-thirds of a mile long and half as broad was given to Professor Agassiz by Mr. Anderson for the purpose of establishing there a summer school of Natural History, and a large laboratory and dormitory building was erected and the school opened in the summer of 1873. This was, according to Professor Whitman, "The first seaside school of Natural History."

The Prayer of Agassiz

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Then the Master in his place
Bowed his head a little space,
And the leaves by soft airs stirred,
Lapse of wave and cry of bird
Left the solemn hush unbroken
Of that wordless prayer unspoken,
While its wish, on earth unsaid,
Rose to heaven interpreted.
As, in life's best hours, we hear
By the spirit's finer ear
His low voice within us, thus
The All-Father heareth us;
And his holy ear we pain
With our noisy words and vain.
Not for Him our violence
Storming at the gates of sense,
His the primal language, his
The eternal silences!

Even the careless heart was moved,
And the doubting gave assent,
With a gesture reverent,
To the Master well-beloved.
As thin mists are glorified
By the light they cannot hide,
All who gazed upon him saw,
Through its veil of tender awe,
How his face was still uplit
By the old sweet look of it,
Hopeful, trustful, full of cheer,
And the love that casts out fear.
Who the secret may declare
Of that brief, unuttered prayer?
Did the shade before him come
Of the inevitable doom,
Of the end of earth so near,
And Eternity's new year?

In the lap of sheltering seas
Rests the isle of Penikese;
But the lord of the domain
Comes not to his own again:
Where the eyes that follow fail,
On a vaster sea his sail
Drifts beyond our beck and hail.
Other lips witthin its bound
Shall the laws of life expound;
Other eyes from rock and shell
Read tthe world's old riddles well:
But when breezes light and bland
Blow from Summer's blossomed land.
When the air is glad with wings,
And the blithe song-sparrow sings,
Many an eye with his still face
Shall the living ones displace,
Many an ear the word shall seek
He alone could fitly speak.
And one name forevermore
Shall be uttered o'er and o'er
By the waves that kiss the shore,
By the curlew's whistle sent
Down the cool, sea-scented air;
In all voices known to her,
Nature owns her worshipper,
Half in triumph, half lament.
Thither Love shall tearful turn,
Friendship pause uncovered there,
And the wisest reverence learn
From the Master's silent prayer.

Louis Agassiz died in December, 1873, and the school was continued the following summer under the direction of his son, Alexander Agassiz, and was then abandoned owing chiefly to its inaccessibility.

On the opening day Professor Agassiz gathered all the students in the large laboratory room and amid the noise of carpenters' hammers occurred the scene celebrated by Whittier in his poem, "The Prayer of Agassiz". This large building which was in the form of an H had the laboratories on the first floor and dormitories on the second, one wing for men and the other for women. In addition to this building there were a mess hall and kitchen and the house of the director. After two sessions these buildings stood unoccupied until about 1894, when they were destroyed by fire. At one time it was proposed to transport the laboratory building to Woods Hole, but Professor Baird found that the cost would not warrant this undertaking.

Agassiz had a number of framed mottoes hung in the laboratory, among them the following:

"Study Nature, not Books."
"The Laboratory is to me a Sanctuary;
I would have nothing done in it unworthy of the Great Author."

These and other mottoes were brought to the M. B. L. by Assistant Director Bumpus about 1893 and were hung in the old library room, irrespective of the fact that the first of these mottoes was scarcely appropriate for a library.

The influence of the Penikese School was out of all proportion to its length of life; during its brief existence many subsequent leaders in American biology studied or taught there, among these, W. K. Brook, Cornelia Clapp, Alpheus Hyatt, David Starr Jordan, Charles Sedgwick Minot, Edward S. Morse, C. O. Whitman, Burt G. Wilder and many others. In address at the opening of the Marine Biological Laboratory in 1888, Professor Whitman said: "At the close of the second and last session at Penikese in 1874, Alexander Agassiz appealed to all the colleges and all interested Boards of Education for support; but all in vain, for not a single favorable reply was received, and so his intention to remove the laboratory to Woods Hole was never carried out. Thus that great and memorable undertaking, after absorbing enough money to build and equip a most magnificent laboratory, was abandoned for

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DUGGER LECTURES ON PLANT VIRUSES

Dr. D. P. Dugger, professor of plant physiology and economic biology at the University of Wisconsin, deliver a lecture on virus diseases of plants on the evening of July 8.

Author's Summary

In this discussion of investigations on some virus diseases of plants the lecturer confined himself to those diseases with typical "mosaic" characteristics, especially the mosaic disease of tobacco. This disease exhibits as the most striking symptom a blotched (deep green and yellow green) appearance of the leaves accompanied by deep-seated histological changes, but little if any necrosis. The virus is readily transmissible by means of diseased juice, but nonculturable outside of the host, so that experimental work of all types involves infection experiments.

After a consideration of rather extensive cytological studies made recently, in which emphasis has been laid on the possible significance of certain intracellular bodies variously identified as "protozoan-like", "pathological", etc. it was pointed out that while cytological studies might be suggestive, final proof of the nature of the casual agency must be based on a variety of experimental studies. These last were presented under three primary captions, filtration, mechanical comminution, and adsorption.

Filtration experiments were carried out with a variety of commercial and adapted filter types, including porcelain, clay, silicious earth, and collodion. These were tested and standardized as to grade of porosity, as far as practicable, by means of hydrophilic colloidal solutions with particles of approximately known size. Parallel control work was done with some small forms of bacteria. The general result of the filtration work was the determination that the infectious agency might exist in the form of particles about the size of hemoglobin particles in a standard one per cent solution, calculated to be about 30-35uu, a size beyond microscopic vision. It was found that for all practical purposes there was no interference with filtration on account of the charge on the surface—whether negative or positive. Such filtration experiments, admittedly, throw no light on the capacity of the virus to be drawn out into extremely attenuate threads, but it was felt that the grinding ex-

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Review

Doctor Dugger's lecture on plantviruses showed such careful, logical and thorough experimentation and such judicious and clear presentation that review of it, beyond his own summary, is unnecessary. The writer will therefore content himself with a few added comments on the subject of virus diseases of plants. Moreover, these comments must be considered as those of a layman or amateur in the field, for virus diseases are quite aside from the writer's field of investigation. The main claim the writer has to knowledge in this field is contact in his laboratory with several investigators of virus diseases. His knowledge of virus diseases has been acquired much as carbon takes up the viruses, by absorption.

There is no doubt about the enormous economic loss caused by these diseases. It is a question whether this loss is greatly exceeded in many crops by the damage caused by the combined injury of fungal and bacterial diseases. Moreover the injury caused by virus diseases seems to be increasing at an alarming rate. A few years ago we found in the literature a few references to "physiological diseases". Today the literature in plant pathology is filled with articles on virus diseases showing the great tolls taken by these diseases. This increase may be due in part to increases in transportation of plant products which distribute both the viruses and their insect carriers and in part this increase may be only apparent. We are just learning to notice losses that have long existed but escaped our attention. The fact that virus diseases are not wholly or rapidly fatal, but manifest themselves by greater or less reduction of yields in many cases, by partial or complete sterility in others or by gradual killing over a period of years in still others, has lead us to overlook for a long time the insidious causes of these losses.

One of the difficulties met in lontrolling virus diseases is the fact that under certain conditions they may be present in a plant in masked form, that is, without showing the usual symptoms or even marked reduction in growth. With changed conditions for growth the disease may develop in its most destructive form. The bulbs of lilies imported from Bermuda and Japan are a good illustration. The plants as grown in these countries show no marked diseased symptoms, but when the bulbs are grown in the United States the plants are mainly worthless due to virus diseases carried on the bulbs. It is only recently that the cause of poor production from these apparently good bulbs has been realized. These countries must learn to grow the lilies free from virus diseases, we must produce such bulbs ourselves or lilies must cease to hold their important place amongst ornamentals. It seems very likely also that these virus diseases are the cause of much of the sterility that has been found in lilies by geneticists; this sympton of the disease being interpreted as a genetic character.

Some of the potato virus diseases—and there are several of these—manifest themselves only when the crop is growing at temperatures below 27 degrees C. At 27 degrees C and above the ordinary symptoms disappear. For some years Bermuda has been trying to grow her seed potatoes for fall planting in Long Island. This has been an uphill job because of the abundance of virus carrying insects. With her best efforts the seed still bore enough virus to reduce the yield forty percent. They report this year that seed crop on Long Island shows fifty percent mosaic and will not usable. The high percentage of mosaic appearing this year may be due only to the cool season. The seed grown other years may have been as bad but the conditions of growth masked the symptoms.

Potatoes can be grown in the north most states of the United States almost entirely free from mosaic, but Bermuda has not formerly been able to use these for seed, for the reason that the potato requires nine to twelve weeks rest and the northern potatoes are harvested only a few weeks before they must be planted in Bermuda. Recently Denny has discovered certain chemicals which force the potato into immediate growth and the far northern potatoes yield much better in Bermuda than Long Island seed. Bermuda's predicament this year with her Long Island seed may lead her to adopt this physiological method of control. This is only one illustration of several methods that have been worked out for partially controlling mosaic diseases in one crop or another. In the main, however, control methods have not been devised and it is going to be no simple matter to work out methods to protect ourselves against the tremendous losses from virus diseases.

Virus diseases of plants in one sense are developing a very interesting situation. These diseases are largely transmitted by insects. Their understanding and control are calling for the united effort of plant pathologists and entomologists. These two groups are accordingly being drawn together in their work. The entomologists are also coming to realize that the direct injury insects do to plants is hardly more significant than their indirect injury as virus carriers.

A group of virus diseases of plants that Doctor Duggar did not include in his discussion are of great interest. This group is well exemplified by "aster yellows". This disease has so far as known a specific carrier, *Cicadula sexnotata*, a species of leafhopper. The virus must also be in the body of the insect for sometime before it is transmissible to other plants. Curiously enough this same disease can be transmitted by the same insect to many different plants including fifteen families and more than fifty species. Curiously enough too the favored host of this insect, China aster, was imported from China where the disease does not appear and the carrier was imported from Europe where the disease does not also appear. Bringing the favored host and the carrier together has caused much trouble. The question naturally arises where was the disease causing agent before the favored host and carrier were brought together. Did it exist on certain plants in America with some other insect carrier, or is it a matter of recent origin? For these questions we have no answer as yet.

The transmission of "aster yellows" and the required incubation period in the carrier's body reminds one of two human diseases, namely; yellow fever and malaria. In both of these human diseases the organisms causing the diseases have been found and studied and are of microscopic dimensions. In "aster yellows" the highest power of the microscope, dark field illumination and ultra photographs with ultra violet light have all failed to show any organisms. These facts add still more to the puzzling nature of the causitive agents of virus diseases of plants, as developed by the lecturer. There are several plant virus diseases that have specific carriers like "aster yellows" and that can be transmitted in nature, so far as known, only by these carriers. To what extent the virus in

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B. of F. Seminar Hears Hall and Galstoff Talk

On Thursday, July 7th, the staff of the Bureau of Fisheries, independent investigators of the laboratory and a number of invited guests from the M. B. L. colony joined in the first weekly round table discussion of research problems in the parlors of the Fisheries residence building. Dr. P. S. Galstaff, chief oyster investigator of the Bureau, discussed in a most interesting manner the Bureau's oyster investigations on the various sections of the coast from Cape Cod to Texas, dwelling particularly on the studies being conducted at Woods Hole and giving the results of his recent experiments on ciliary motion in the oysters with its bearing on hibernation and self purification and also experiments on artificially induced spawning. Dr. Galstoff outlined his investigation proposed for the coming summer, mentioning studies on the effects of heavy metals on the metabolism of oysters in which he will work in collaboration with Dr. Samuel Lepkowsky, biochemist from the University of Wisconsin.

Dr. F. G. Hall from Duke University, a temporary investigator of the Bureau, discussed his studies which began several years ago on changes in the composition of fish blood in response to changes in the environment. Dr. Hall explained his studies on the effects of asphyxiation and changes in salinity as shown by the composition of the blood system. Both papers inspired a free and informal discussion, which was followed by a social hour during which refreshments were served. Many enjoyed dancing in the smoking room, while both newcomers and old timers were afforded an opportunity to become acquainted.

Apparatus Rooms Entail Much Care

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Location of the more General Equipment

Many of the heavier pieces of apparatus are not loaned but located at convenient places about the Laboratory buildings connected for use, or available to be moved into a suitable spot for work. Smaller and more portable outfits of the same kind, however, are to be found in one of the apparatus store rooms and loaned on application. In such a list of equipment with definite location, may be included the balances or scales, centrifuges, filter-pumps, gas tanks, Kjeldahl shelves, ovens, photographic equipment, refrigerators and cold rooms, Soxhlet extractors, sterilizers, etc. Briefly their locations are as follows:

Baances
- 200 gram capacity, 1/10 mgm sensititivity, analytical type, Rooms 112, 119, 212, 316
  - North wing — O. M.
  - First floor — Bot.
  - Brick Laboratory
- 2 kilogram capacity, Room 119 — Br.
  - North wing — O. M.
  - First floor — Bot.
- 5 kilogram capacity Room 212 — Br
- Trip scales and torsion balances in Balance Rooms and on application through Apparatus Room Office.
- Precision balances and weights in care of certain individuals.

Centrifuges
- Rooms 110, 122, 205, 313 Br.
- First floor — O. M.
- Portable electric and hand centrifuges on application.

Filter-pumps attached to water pipes in most laboratory room or on application.
- Pumps of glass construction obtainable through Chemical Room
- Special equipment for intermittent work and high vacuum by application through Apparatus Rooms Office

Kjeldahl distilling and digesting shelves
- Room 108 and 121 — Br.
- Extra shelves and equipment on application.

Photographic safelights, etc.
- Rooms under Invertebrate Zoology Class Room, in charge of Dr. E. C. Cole, Room 24, O. M., Room 315 Br.
- Safelights (Wratten & Wainwright screens) on application to fit ceiling fixtures in Laboratory dark rooms.

Refrigerators
- Special cold rooms, basement, Brick Lab. (Adjustments of temperature in charge of Mr. T. E. Larkin, Superintendent of Machinery, Room 7-a, Br.).
- Refrigerators with ice Room 122, also corridor of third floor, Brick Lab.
- North wing — O. M.

Soxhlet extractors
- Room 110 — Br.

Sterilizers, including vertical autoclaves, Lautenschlager hot air-ovens, etc.
- Rooms 1, 111, 121, 206, 315 Br.
- First floor — Bot.
- *Freas Drying Oven* Room 110, Br.

X-Ray equipment in charge of of Dr. J. W. Maver, R. 343, Br.
- Smaller portable devices, Apparatus Rooms.

Special Service Information

In addition to the equipment for scientific work several matters associated with the use and construction of apparatus have been developed in the Laboratory along different lines. Those in connection with the Apparatus Rooms, or which in certain instances affect more than one individual or stock room and involve special apparatus are briefly mentioned below. Occasional reference to this information will be found helpful in expediting research work in one way or another.

Catalog File. Adjoining Room 216, Brick Laboratory, will be found a file of apparatus catalogs and bulletins of numerous manufacturers and dealers, arranged alphabetically and kept up to date. Investigators who desire to procure special information concerning cost and availability of apparatus may may consult this file or borrow for brief periods the printed matter on hand.

Electrical connections and lighting fixtures. Desk lamps and table lights are furnished with each room, or on application to Mr. Bisco, Room 6, Brick Laboratory. Special fixtures, changes in the wiring, or connections to the special low or high voltage circuits may be arranged when necessary thru Mr. Larkin, Room 7-a, basement, Brick Lab. *Before attaching special devices to the electric outlets it will be well for each investigator to look over the voltage and ampere rating on the name plate, or consult with Mr. Larkin.* The general lighting circuit in all buildings of the Laboratory is 115 volts, Direct Current, and the outlets will normally carry 5 amperes satisfactorily (550 to 600 watts). Under these conditions resistance units are required for low voltage devices; *transformers cannot be used* in the direct current circuits.

It will be well for each one to bear in mind that one side of the electric circuits is connected to the ground and hence leakage resulting in possible damage to

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The Collecting Net

A weekly publication devoted to the activities of the Marine Biological Laboratory and of Woods Hole in general.

(*Application for entry as second-class matter is pending.*)

The Universal Press
New Bedford Woods Hole
Massachusetts

Our Home

We appreciate greatly the privilege of using the Trustees Room which was extended to us during the preparation of the "Directory for 1927". At this time frequent consultation was necessary with those persons working in the business office of the Laboratory, and the proximity of the latter lightened our task.

The Collecting Net has now become established in its new headquarters in the Old Carpenter Shop which was the "Bake Shop" in the old whaling days—and there it finds ample space and quiet. An embryo project thus installs itself in an ancient setting. Here were made the sea biscuits which the whalers stored in the hold of their vessels in preparation for their long and adventurous voyages around Cape Horn. Later it was a tenement house, but it was not until 1916 that the Laboratory acquired this historic and picturesque building.

Sunday Singing

Once it was the custom for members of the laboratory to gather every Sunday evening at twilight for informal singing. At these gatherings "laboratory" songs were sung along with the old melodies known by every one. The revival of this custom beginning next Sunday evening will do its part in restoring the "community spirit" which has been partly lost with the rapid growth of the laboratory. Older people number these evenings of singing as among the most enjoyable hours spent at Woods Hole—and we are confident that those who can find time to this Sunday will attend again the following week.

DIRECTORY ADDENDA ADDITIONS

Shauffler, W. G. phys. (Princeton) Br. 225.
Mathews, A. P. prof. phys. Cincinnati Br. 344.
Phipps, R. mechanician, mechanical dept.

CORRECTIONS

Crane, S. collector.
Sribyatta, L. fel. Rockefeller Inst. Br. 111.
Thorn, Louise C. sec. to Dr. Crocker.

"The Story of Woods Hole"

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shelves of each rack. The wall shelf racks are indicated by WA, WB, etc. and the tables as TA, TB, etc. There is a separate locked cabinet filled with drawers for the dyes, drugs and some of the rarer metals. As a minor point, but possibly of interest it may be mentioned that the numbers of the shelves, the chemical symbols of the bases occupying certain shelves and other similar designations are stenciled with a water paint and subsequently brushed over with shellac. Other more complete and time-consuming labeling, more subject to change, is simply neatly lettered on the edges of the shelves with soft yellow chalk. When this is sprayed with a solution of shellac in an atomizer it is fixed so that it cannot be readily rubbed off. When changes are desired the whole label can easily be removed with alcohol and a piece of cloth.

Careful Records Kept

Some ten years ago or thereabouts the Chemist felt it incumbent upon him to get up an elaborate catalogue of the Chemical Room supplies which would also be used for inventory purposes. While a card catalogue has many advantages, it is not easily handled and is liable to become mixed up when used by more than one person. Consequently it was decided to use a loose leaf catalogue with intercalated sheets for inventories bearing the names not only of the Chemical Room but of the various biuldings in which some of the supplies might be located at the time the inventory is taken. By pursuing the policy of entering all the various sizes of given articles, whether at that time in possession of the Laboratory or not, and by leaving spaces for the intercalation of added items in their proper places, the catalogue, although very bulky, was of such a character that very few changes in the leaves have had to be made since. Not only were the items shown, but also the catalogue numbers from a well-known and large firm, such as Eimer and Amend, were indicated and on the backs of the opposite pages, which were blank, corresponding illustrations cut from the catalogue were pasted, thereby making it much easier for assistants unfamiliar with the supplies to identify the various articles. Dates of purchase and also catalogue prices were added. Although the latter are subject to considerable changes they nevertheless furnish general indications as to the values of the articles. The firms are indicated by initials and in the front part of the catalogue there is a key to these initials giving the full names of the firms and their addresses, such data being often very uesful in ordering more supplies. Other abbreviations used are also explained in this place. The extension inventory sheets can be removed when filled and others inserted in their place. The location in the Chemical Room of each item is also noted on the main page after each item. While such a catalogue is not very often consulted by members of the staff who have become familiar with the location of supplies it is often very useful to new members and is necessary for stability in their general arrangement.

Before taking up the general functions of the Chemical Room and the system upon which it is run, it may be well to remark that the Chemical Room is largely postplanned, not preplanned. In postplanning there is simply a codification of the system after it has been evolved by actual experience. Preplanning consists in laying out a system even down to minute details before it is put into actual operation. While preplanning is to some degree necessary, preplanners are usually more or less of a nuisance in imposing their ideas, aesthetic, utilitarian and otherwise, upon their unfortunate victims. A postplanned codification of the system pursued in the Chemical Room, as evolved from past experience, was embodied by the Chemist in a pamphlet, some eight or ten years ago, and presented to the Director. The Director glanced at the somewhat bulky pamphlet, his face at first fell and then brightened as he said "Well this simply embodies what we have been doing right along, doesn't it?" Upon being assured that no preplanned atrocity was about to be inflicted upon the Marine Biological Laboratory public, he promptly approved the document and handed it back to the author, thereby deftly avoiding its perusal.

It is proposed to quote freely from this admirable document at the risk of repeating various notices already seen *ad nauseam* by members of the M. B. L.

The department of "Chemical Supplies", located in the "Chemical Room" has charge of the ordering, storing and distribution of all laboratory apparatus (excepting the more delicate and expensive apparatus already alluded to as in charge of Professor Pond), glassware and reagents including drugs and dyes, owned by the M. B. L. and used by the M. B. L. investigators and classes during their work in the M. B. L. laboratories. It does not sell or in any way provide supplies to be used elsewhere than in the M. B. L. The titles "Chemical Supplies" and "Chemical Room" are thus not entirely accurate but were chosen to sharply differentiate the department from the "Supply Department" (under Mr. Gray in the Stone Building) which furnishes biological material (animal and plant) not only to investigators and classes of the M. B. L. but sells the same to various other institutions and also sells certain other supplies which investigators at the M. B. L. may require for their permanent use. The Chemical Room staff makes up the various fixing, hardening, preserving and staining solutions, and certain standardized reagents used by investigators and classes in ordinary biological and chemical work. It does not, however, undertake special chemical work for individuals or classes.

The main duties of the Chemical Room staff are thus (a) ordering supplies, (b) keeping these supplies in order and in proper condition while stored in the Chemical Room, attending to their distribution to investigators and classes and to their return, after use, in proper condition to their proper places in the Chemical Room, and (c) making up certain solutions etc. for biological and chemical work. It may be remarked that certain supplies to classes are kept permanently outside the Chemical Room and are largely under the care of the instructors but over these the Chemical Room staff exercises a certain amount of supervision. In certain cases also where investigators are reasonably certain of returning the next season and of using the same supplies, by signing a card provided for that purpose the supplies remain in their room until next season or are kept apart in the Chemical Room until their return the following season.

(To Be Continued)

Orchestra Dances to Be Held Regularly by Club

M. B. L. Club's first dance of the season was held Saturday evening, July 9, and was so well patronized that plans have been completed for orchestra dancing at the Club regularly every Saturday evening during the summer months.

A double stag party will be given at the next dance in an effort to let newcomers become better acquainted. Everyone wishing to attend the dance on Saturday, July 16, is requested to come singly. This applies particularly to girls. Gentlemen are also requested to be unaccompanied, although this rule will not necessarily be in effect at the end of the dance.

Scholarship Fund Not Yet Boosted

Mr. Leonard B. Clark has not yet purchased the Ford from Mr. Cushman of the Crocker Garage. The latter, with his corps of mechanics, has been working almost incessantly — but still he does not feel prepared to let the car get outside of the garage under the weight of a six-foot Canadian (we mean that he is afraid that the car might not remain intact under circumstances such as these).

However, we learn that things have been put up in splints and packed and supported to extent almost sufficient to get by. Clark, it is understood, will have it out on trial this week-end. We are wondering how far he will be able to get and just how much of it he will be able to take back to Mr. Cushman.

Pressure is being brought to bear from every possible source —and the chance of getting the ten dollars for our cholarship fund seems to ge a good one.

It is rumored that Mr. Clark had an engagement to go out for a drive on this coming Sunday with a certain young lady. For some reason, shortly after reading the last issue of *The Collecting Net,* she told him that it would be quite impossible for her to keep the engagement. We apologize to Mr. Clark for having upset his plans, but can only remind him that it has been the long-standing policy of *The Collecting Net* to report the facts as it knows them to be.

Apparatus Rooms Entail Much Care

(Continued from Page 5)

a device or to the permanent apparatus about the buildings may result if care is not exercised. Keep electrical outfits away from the water and the concrete floors or walls. Ask for information in case you are not certain of the outfit you desire to use.

Glass-blowing Service. For small and minor repairs to glass apparatus individual outfits, consisting of blast-lamps and air bellows or motor blowers may be loaned for short periods from the Apparatus Rooms. More difficult work may be arranged through a glass-blower, available at certain times during the season. Arrangements should be made in advance for this service either through the Chemical Room or Apparatus Rooms.

Excepting certain materials regularly stocked by the Laboratory, the work is done at cost, the glass-blower's time being the chief item, at $2.50 per hour.

Incandescent lamps. Incandescent electric light bulbs with standard screw (Edison) base for desk and general laboratory illumination are provided through Mr. Bisco, for use in the devices which are supplied to investigators.

Replacements for special apparatus, scientific equipment, heating units, and the like are supplied by the Apparatus Rooms office for those devices owned by the Laboratory.

Special lamps, bulbs with bayonet bases, miniature lights, etc. for experimental work may be purchased through the Supply Department, or through the local shops. The Penzance Garage near the Laboratory buildings carries a stock of flashlight and automobile bulbs.

Mechanical work. A machine shop is located in the Brick Laboratory, equipped for certain operations with standard and special tools, and with a machinist, Mr. R. E. Phipps, assigned to apparatus work. Investigators who have need of repairs of a technical nature or special construction may make arrangements either through the Apparatus Rooms office or by direct application to Mr. Larkin or Mr. Phipps. Excepting minor repairs a record is made of labor involved and stock used, since in most cases special apparatus is constructed of such a nature as to be used again by workers coming to the Laboratory. Special apparatus, or expensive construction is charged at cost to the individual for whom the arrangements are made, if in the judgment of the Laboratory the work does not provide generally useful apparatus.

Oxygen, Hydrogen, Nitrogen, Carbon Dioxide, etc. The more common gases in metal cylinders (100 and 200 cu. ft. bottles) are available through the Chemical Room if application is made in advance. Small (fractional cubic foot) cylinders of oxygen and carbon dioxide are provided with special attachments through the Apparatus Rooms. All reducing valves, regulators and fittings are supplied by the Apparatus Rooms.

Special care is frequently necessary in the fitting of the various regulators to different makes of tanks, preferably at the time of initial connection for use. Application to Mr. Larkin for inspection and advice may assist in avoiding unnecessary leaks breaks and accidents as well as protect the Laboratory against receipt of dangerous tanks or connections.

Everyone should avoid handling gauges, tank valves and connections, with greasy or oily hands, rags or tools. With oxygen especially *keep oil and grease away.* Use small tools which are properly adjusted for the nuts and valves, or obtain

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The official Laboratory physician this year is Dr. S. D. Blackford, who will hold office hours in Dormitory Room 103 from 10.30-12.30 A. M. Those who wish to consult Dr. Blackford should first procure a slip (the the Maine Office in the Brick Building) which will be given on payment of a fee of one dollar.

Apparatus Rooms Entail Much Care

(Continued from Page 7)

directions and assistance from the Apparatus Rooms or the Machine Shop in case of doubt.

This year the Laboratory is equipped to fill small oxygen cylinders and also power bottles of carbon dioxide. Requests for small quantities of gas at low and moderately high pressures may be filled upon notice left with the Chemical or Apparatus Rooms.

Photographic work. Increasing demands on the Laoratory and the assignment of most of the dark rooms for scientific work of a physical nature considerably limits the available space for photography. Portable devices are loaned by the Apparatus Rooms for photomicrography, etc.

The photography of apparatus, experiments in progress, set-ups, and charts or drawings may be arranged for through Mr. Duggar, Room 276, Brick Laboratory. Lantern slides, as well as process negatives, contrast printing, enlarging and reducing or retouching may be done at cost. Likewise mechanical drawings or arrangements of tables for copy can be done with special arrangements. A limited amount of panchromatic and isochromatic work can be handled by either dark development or desensitization.

Photographic chemicals are usually available in the Chemical Room, omitting special reducing agents. Commercial plates and paper, however, are not furnished by the Laboratory.

Storage of valuable papers, apparatus and fine metals. For the convenience of investigators who plan to continue research at the Laboratory at a later time, or desire temporary storage during absence, a set of vault-drawers, vault-cupboards, and safe deposit boxes are available. Arrangement for these may be made through the Apparatus Rooms or the Business Office.

Statistical calculations, progressive analysis, and comptometry. Use of calculating machines may be arranged for through the Apparatus Rooms Office. At different times during the season it is frequently possible to arrange for experienced assistance with the machines which are available for use, or for instruction in the use of them for special operations. Ordinarily the mechanical calculators are in demand and advance notice will be required to care for individual requirements.

THE CLUB DANCES

We are indeed glad to learn that the M. B. L. Club will hold an orchestra dance every Saturday evening. These dances will fill a long felt need and will be especially appreciated by those who like to dance and who do not own cars and cannot afford to pay the relatively high prices which are charged at the tea rooms and dance halls in the vicinity.

Members of the M. B. L. Club can now attend an orchestra dance without involving any expense to them. Of course some of the larger dance halls offer better music and a better floor, but we feel that this is counterbalanced alone by the friendly atmosphere of our own little dance. Here one is not tied down to a limited group but can dance with his friends, and in the course of the evening meet many fellow students and research workers, with whom they might not otherwise have the opportunity of becoming acquainted.

We urge those who did not attend the last Club dance to be in attendance next Saturday evening, so that they too, may enjoy the spirit of good fellowship which prevails. It is hoped that many will come without partners because in this way the opportunity of meeting many new people will be still greater.

This fall Dr. Robert T. Hance goes to the University of Pittsburg as professor and acting head of the department of zoology. Dr. Hance has been at the Rockefeller Institute for Medical Research for several years.

Dr. Donald B. Young has been chosen for the headship of the department of zoology of the University of Maine. Dr. Young has been associate professor of zoology at the University of Arizona.

EMBRYOS

Fundulus greeted us upon our first day at Woods Hole. Before we had heard four of Dr. Goodrich's lectures on the teleost, we were already adept in military tactics. There would have been no doubt of this in the mind of even a uniformed observer if he had seen normally vertical microscopes assume in unison a horizontal position. Such elaborate preparations are necessary for even a fleeting glance of the elusive Cunner polar bodies.

Dr. Charles R. Stockard of Cornell Medical School, in his special lecture, told us that we ourselves are not entirely responsible for our present condition, for there are good and bad eggs, and environment is extremely powerful. It is even possible by nearly freezing the unsuspecting eggs to produce wtins. All the young hopeful scientists immediately attempted twinning but returned with little success, for even the embryos have become immune to Woods Hole weather.

However, the class has no doubt but that environment plays a very important part in development — after treatment with alcohol, did not ears flop like eyes?—but of course we realize that such subjects are all over the heads of the Invertebrates.

While waiting for twins to appear, the atmosphere was constantly punctured with cries of, "Where's the micropyle?" But why should this cause so much consternation? The micropyle is right in the class! We even seen an occasional first cleavage.

Captain Veeder has good reason to be proud of his good ship Cayadetta. On the first field trip of the Embryos it cruised about the fish traps for an hour, scanning the horizon, waiting for the noble Sagitta to arrive. But then it must be remembered that the Sagitta went two miles up and down for every one mile ahead.

Discovered—a new species—Metridium echinarachniensis. We give all the credit for this discovery to Dr. Plough of Amherst but it must be remembered that had it not been for the able assistance of Dr. Rogers of Oberlin this discovery would not have been possible.

At the end of a four-day marathon between the students and Coelenterate planulae, the planulae were declared to be still in the lead.

Neither by natural nor artificial means could Gonionemus be persuaded to lay eggs. Once more this famous Woods Hole citizen reniged.

To break the monotony of regular lectures held to the tune of speed baots in the harbor, Dr. Hoadley spoke on studies on the development of the chick—and Dr. Richards on the continuity of the germ plasm.

After two lectures by Dr. Rogers on Echinoderms road signs appeared on all sides:

"Please walk gently.

Embryos must not be disturbed."

On Saturday Dr. Plough will give a special lecture. Dr. Just's lecture on fertilization comes some time next week.

MAST GIVES REVIEW OF WORK ON AMOEBA

First in Series of Evening Lectures

The lecture of Professor S. O. Mast consisted of a presentation of the more important results and conclusions thus far obtained and formulated concerning structure, locomotion, and stimulation in Amoeba proteus.

He faced the old problem of either spending most of his time on the work of himself and his students and of paying scant attention to the previous work, a course which is generally adopted, or of discussing at some length the previous work and devoting less time to his own work. He chose the latter alternative.

The first ten minutes of his lecture were devoted to a discussion of the views of Schultze, Berthold, Butschli, and others. In this he stressed particularly the two surface tension theories, the one formulated by Berthold and the other by Butschli. He then demonstrated by very convincing evidence that a number of important phenomena concerned with locomotion in Amoeba are not in accord with either of these theories. Among these he emphasized the "biting" in two of Paramoecium and Frontonia by Amoeba. He showed figures by himself and Root, Beers, and Kepner and Whitlock of Amoeba feeling on these two organisms. These figures, in which the body of the ciliate is represented as being drawn out so as to form a small strand in a part of the food vacuole (and the evident fact that the part of the ciliate not yet in the food vacuole was under pressure, because of changes in its shape), seem to answer the criticisms that have been made against Mast's contention that these organisms are actually "pinched" in two by action of the amoebae. They show that the Paramoecium or Frontonia does not really "pinch" itself in two, that it is not cut in two by a digestive process, and that this phenomenon can not be due to surface tension in accord with the theories mentioned.

He presented with the aid of free hand sketches and slides his conclusion that the body of an Amoeba can be divided into three chief regions, an outside fairly tough membrane, the plasmalemma, an inner region, the plasmasol, and an intermediate region, the plasmagel. He maintained that the plasmagel changes to plasmasol at the posterior end; that the centrally located plasmasol flows forward to stream out at the anterior end like a fountain: and that the sol is converted again into gel at the anterior end.

One of his slides representing the structure of Amoeba was made from a figure in his splendid paper on Amoeba which appeared last winter. This figure, drawn with the aid of his student, the Japanese investigator, Ibara, is destined to appear in many textbooks.

He concluded that there are three chief factors concerned in locomotion: first, a continuous change from the gel to the sol state at the posterior end and the opposite at the anterior end; second, an increase in elastic strength in the plasmagel from the anterior to the posterior end; and third, adhesion to the substratum. The third factor seemed to be demonstrated conclusively by graphs showing the rate of locomotion of Amoeba on various substrata. These indicated that on redistilled paraffin there is no adhesion and consequently no locomotion and that on ordinary glass, quartz, and pyrex glass the rate is about the same, after initial differences, while on commercial paraffin the rate of locomotion is considerably higher.

Consequently, he maintained that, if the three factors involved in locomotion are the ones stated above, then stimulation consists in a modification of one or more of them.

His conclusion that stimulation by light and by electricity are fundamentally different was based on the work of his students, Folger and Luce. He

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DUGGER SUMMARY

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periments, next discussed, served this purpose.

The virus was subjected to mechanical comminuation tests by means of comparative studies upon bacteria and upon diseased tobacco juice, the grinding substance being diatomaceous earth. Grinding was effected in an agate mortar provided with a motor-driven excentrically arranged pestle, a device frequently employed in grinding bacterial cultures. Periods of grinding ranging from one to six hours were found to be effective in rupturing both vegetative cells and spores of bacteria, but no appreciable injury was done to the virus treated in the same way. While such results yield no data for a direct determination of size, they are regarded as indicating that the virus agency cannot exist as a large, flexible, attenuate, or semi-liquid body; and again the data suggest an extremely small size of the virus agency.

A variety of experimental results seemed to find explanation in a high adsorptive capacity on the part of the virus, so that direct determination of this property was made by using substances of diverse type. Among the various adsorbing surfaces, charcoal and clay, for example, were contrasted with such basic materials as precipitated calcium carbonate and calcium phosphate. Charcoal was found to be surprisingly adsorptive of the virus, this disease agency being rendered inert in respect to infection when one gram of juice (diluted) was treated for a relatively short period (12 hours) with one gram of blood charcoal, calcium carbonate was less effective than charcoal, while calcium phosphate—probably soluble on inoculation into the tissues—was still less effective. By comparison with bacteria and other organisms, this capacity of the virus to be adsorbed was considered further to be proof of its ultramicroscopic size. In fact, the first two lines of study stressed were regarded as showing that particles of minute size (colloidal dimensions) are involved, and rather extensive adsorption experiments indicate that large organisms are not concerned.

After considering briefly other lines of experimentation and some possibilities of the so-called enzyme or toxin nature of the virus, it was pointed out that on the whole this virus shows characteristics very suggestive of a low order of life, subcellular, only sightly responsive, and perhaps with a very inferior degree of organization. This possibility was made the basis of a purely speculative discussion of the origin of living organisms. Our ideas of the criteria of life are derived exclusively from observations on the complex cell. Could such complexity originate at one jump? In general, this discussion was a plea for a careful consideration of the problem of the origin of life, that it may be brought more nearly into line with the facts known concerning the development of other materials on the earth, and more particularly into line with the universality of evolution.

DUGGER REVIEW

(Continued from Page 4)

these, other than aster yellows, requires a period in the insect body is not fully determined.

Whether we can think of the causative agents of the "aster yellows" type of diseases as filterable viruses is not known, because as yet they can not be transmitted except by specific carriers or by budding or grafting.

Perhaps one of the longest known virus diseases of plants is "peach yellows". It has been known at least 135 years and has been rather intensively studied for forty years. In spite of this we do not even know how it is transmitted from a diseased to a healthy plant, let alone knowing anything about the causative agent. We only know that it is not transmitted by the ordinary needle or scalpel method. To find the carrier of peach yellows will be a neat scientific contribution. Assuming that the carrier is an insect, the difficulty is evident in contrast to "aster yellows", when one realizes that asters have about a dozen common insect pests and the symptoms of the disease appear in the plant two or three weeks after the infected insect feeds on the plant, while on the peach there are about one hundred fifty rather common insect pests and symptoms of the disease do not show up for more than a year after a diseased bud is grafted into the plant.

In closing I might say taht I feel the lecturer needed to make no apology for the speculative portion of his lecture in which he suggested that the causative agents of virus diseases are a very simple type of organism—much simpler than the simplest forms we have previously known and studied and are accustomed to think of as the simplest possible living beings. The same is true of his suggestion that even today such extremely simple organisms may be in process of creation. Being evolutionists we can hardly believe that life started at a single jump with complex things as the simplest bacteria with their complex protein molecules and their highly developed metabolism. Indeed perhaps the earlier organisms had much simpler proteins, and much simpler metabolism than any known organism. Perhaps, too, some of these very primitive organisms have remained over to prey upon the higher ones as they developed. It will be no more strange for us to discover a series of organisms simpler than the simplest bacteria than it was for Leeuwenhoek to discover the microscopical "beasties" in his day. In the future we may have to follow in the footsteps of Spallanzani, Pasteur and others in working out the methods of reproduction, the cosmic significance and the nature of the metabolism of this very simple order of life. Such scientific imagination is productive rather than dangerous when it is backed up by the careful logical sort of experimentation shown in the lecture.

Dr. William Crocker
Boyce-Thompson Inst. for Plant Research

Mast Gives Review of Work on Amoeba

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contended that the orientations to these two stimuli are merely outwardly similar; that in the electric current pseudopods are formed on the cathode side, owing to solation on that side; while in light, pseudopod formation is inhibited on the illuminated side owing to gelation on that side. This recalls his view that the process of orientation of Volvox in light and in the electric current are fundamentally dissimilar. His discussion of the work of his student, Folger, was tantalizing in its brevity. It appears to show conclusively that the Bunsen Roscoe law does not hold for the reactions to light in Amoeba; that as the luminous intensity increases the length of the latent period increases rapidly to a maximum and then decreases more slowly to a minimum, while the length of the stimulation period decreases rapidly to a minimum and then increases slowly; and that in order to produce a response to light in Amoeba, consisting of a cessation of movement, about thirty times as much energy is required in very bright light as is required in weaker light. According to the Bunsen Roscoe law equal amounts of energy would be required.

His contention that there is no specific relation between the chemical content of the surrounding medium and the form assumed by an Amoeba was supported by slides showing that Amoeba proteus can assume all its possible shapes in the purest water that can be produced in a pyrex glass still. Moreover, he demonstrated that locomotion in Amoeba occurs in such water, thus contradicting the view that locomotion is possible only in solutions containing certain salts, especially calcium, excepting possibly extremely minute amounts.

He also presented evidence showing the relation between the rate of locomotion and temperature and hydrogen ion concentration. With the aid of slides he discussed the reletion between hydrogen ion concentration, sugar concentration, and urea concentration and the total volume of Amoeba, as well as the relation between these factors and the plasmagel-plasmasol ratio. Here again one was tantalized by his hurried treatment and by his failure to tell the methods used in measuring the volume and the relative amounts of plasmasol and plasmagel, in measuring the rate of locomotion, in regulating and controlling the temperature, and in measuring and controlling the hydrogen ion concentration. One felt that this was perhaps the most important part of the lecture and yet lack of time prevented the adequate treatment that the results deserved.

One came away from the lecture impressed by the fact that a tremendous amount of work of the utmost importance had been done by Professor Mast. Furthermore, one was conscious of the fact that an impressive program of work had been outlined.

William L. Dolley, Jr.

Conservation Work of Bureau of Fisheries

(Continued from Page 1)

Although the work of the bureau has broadened to some extent since that time, its chief activities are still the same as when first established. It is concerned primarily with the discovery of the depletion of our fisheries, with causes and with possible remedies. Through its participation in fish cultural operations, it has actively striven to prevent depletion and to build up fisheries which have been depleted. The great salmon fisheries of Alaska, one of the most valuable in the world, are under the control of the Department of Commerce and are administered by the Bureau of Fisheries.

The bureau consists of fonr main divisions: the divisions of scientific inqdiry, fish cnlture, fishery indlstries and the Alaska service. The work of the division of inquiry includes practically all of the work for which the bureau was originally established and involves the study of the various fisheries in order to determine yhich are showing depletion and what methods may be applied toward their conservation. The division of fish culture is concerned mainly with the proagation and distribution of various food and game fishes and also conducts the rescue operations in the waters of the upper Mississippi Valley by means of which millions of fish left stranded in shallow pools by the receding waters after the spring floods, are saved from certain death and returned to the river. The division of fishery industries collects statistics which are of fundamental importance in revealing the character and extent of depletion, and which also serve trade purposes. It conducts investibations of methods of preserving and of lsh merchandisiny in order to provide for the hiphest economic use of the harvests taken. The Alaska service administers the laws yoverning the filsheries of Alaska, which include the salmon, herring, halibut, cod, and clam fisheries, and a number of others of lesser importance. It also handles the important fur-seal industry, centered in the Pribilof Islands —an industry so closely related to the fisheries that its care has been placed in the hands of the Bureau of Fisheries.

(To Be Continued)

"THE CHEMICAL ROOM"

(Continued from Page 2)

items are lumped it is rather difficult to tell what portion of these figures belong to the Chemical Room proper. The items are quoted as given. 1888, chemicals, $180.50; scientific apparatus, inside and outside equipment, $1,741.40. 1889, increase of equipment (apparatus, etc.,) $866.16. 1890, apparatus, chemicals, etc., $391.70; alcohol $35.50. 1891, chemicals and supplies $377.61; alcohol $110.40. 1892, chemicals $153; alcohol $114; "Supplies" $660. 1893, chemicals $393.81; equipment $288.01; supplies $730.55. 1894, chemicals, glassware and instruments $569.97. 1895, (and 1896?) chemicals, glassware and instruments $1431.62. 1897, chemicals $154.24; instruments $6839. 1898, chemicals $543.19; instruments $5120. 1899, chemicals $196.93; supplies $1359.67. 1900, chemistry department, $1888.82; instruments $4531. 1901, chemicals, chemist supplies, etc., $410.43. 1902, chemicals, chemist supplies, etc., $918.20. 1903, chemicals, chemist supplies, etc., $1213.17. 1904, chemicals, chemist supplies, etc., $948.05. 1905, chemicals, chemist supplies, etc., $906.32. 1906, chemicals, chemist supplies, etc., $705.22. 1907, chemicals, chemist supplies, etc., $519.14. 1908, chemicals, chemist supplies, etc., $752.20. 1909, chemicals, chemist supplies, etc., $659.32; instruments and laboratory supplies, $131.15.

In 1910 the policy was adopted by the Chemist of keeping an account of all the bills for Chemical Room supplies as they were O. K.'d and sent in to the Business Manager's office. Various items such as freight, express charges and sundry doubtful items and also the salaries of the Chemical Room staff are included in the Reports but not in the Chemical Room account. Consequently the figures from the Reports are larger, but the former figures more accurately represent the actual expenditures of Chemical Room supplies and owing to doubtful items will be quoted simply in round numbers:

1910, $825; 1911, $300; 1912, $730; 1913, 1585; 1914, $1780; 1915, $1130; 1916, $1260; 1917, $1000; 1918, $850; 1919, $885; 1920, $1065; 1921, $1365; 1922, $1710; 1923, $2080; 1924, 1780; 1925, $5755; 1926, $3500.

It may be remarked that the famous researches by Dr. Jacques Loeb were carried on in a separate laboratory built by the Rockefeller Institute and various chemicals used by him were principally paid for by that Institution and are not, of course, included in the above expenditures.

Two of the earliest pieces of complicated physical apparatus, precursors of the avalanche to come, were an Ostwald thermostat purchased in 1908 and an Einthoven string galvanometer (Edelmann make) purchased about the same time at the request of the ever enthusiastic Dr. A. P. Mathews. This latter apparatus was not put into actual use until 1915 when the necessary accessory parts were purchased. It has since then, until 1925, been under the fostering vigilant care of Dr. Walter E. Garrey.

It would be interesting, but would be too great a task, to analyze the various items purchased through the Chemical Room during all these years, but it would be safe to say that such an analysis would simply reveal the tendency, well known to everybody, for biological work to assume more and more a physico-chemical character. This tendency culminated in the necessity for better provision to be made for purchase, housing and care of the ever increasing volume of delicate apparatus and resulted in what might be termed a partial binary fission of the Department of Chemical Supplies. The problem apparently of the "powers that be" was to find an individual not only an expert in some line of biological work, but also an enthusiast in the matter of apparatus and moreover such a genial disposition as to withstand all the assults upon his temper involved in such a function. Their immediate and unanimous choice, as the writer understands it, was Professor S. E. Pond who has also been inveigled by the Editor of *The Collecting Net* into furnishing an article on this subject.

Returning to the Chemical Room proper, a rough survey seems to show that the few items mentioned in the inventory of 1904 have grown in number to about 500, each of such items as beakers, bottles, filter paper, rubber stoppers, rubber tubing, etc., with their great variety of material, quality, size and number, being considered as one item. We also find that the chemicals, drugs and dies have increased to about 1,000 or more.

Expanded in 1925

Before describing the system upon which the Chemical Room is run it might be well to take a glance at the physical characteristics of the present quarters of the Chemical Room occupied since 1925.

These quarters consist of a long room about 155 ft. long by about 20 ft. wide. From one end there projects an L extension about 26 x 23 ft. This and the adjoining part lying in the newest part of the Laboratory is occupied more especially by the equipment required for the chemical activities of the staff. There is also at the other end a small adjoining room about 8 x 6ft. used as an office for the clerical work, storage of catalogues, correspondence, etc., pertaining to the Chemical Room. The furnishing of the Chemical Room consists of a long series of open transverse shelf racks, mostly with iron movable shelves; of wall shelf racks with movable iron shelves; of cabinets; tables and two hoods. The cabinets, which were devised by Dr. Gilman A. Drew when Resident Director of the Marine Biological Laboratory, deserve a special mention. They consist of a number of compartments, the upright partitions separating them being composed of grooved paraffined boards into which corresponding flanges of the drawers fit. Each compartment has a separate door. The drawers are also heavily paraffined and their sides are provided with vertical grooves on the inside into which dividing partitions can be inserted. It is evident that with such an arrangement not only can the drawers be spaced either close together or any distance apart according to their contents, but they can be taken out entirely and the compartment converted into a closet or movable shelves can be inserted in the grooves instead of the drawers The paraffining is also a very important feature in a damp seaside climate like that of Woods Hole. Not once in the memory of the writer has a single drawer in these cabinets stuck or even functioned poorly. Each drawer is provided with a card holder upon which its contents are indicated and on the outside of the door of each compartment a card is thumbtacked upon which is indicated the general nature of the contents of the whole stack of drawers contained in that compartment.

A double letter system is used in designating these various articles of furniture, the cabinets being all called C and each one by a secondary letter, e. g. CA, CB, CC, CD, etc. The open shelf racks are designated by R each one being designated RA, RB, RC, etc., numbers being reserved for the individual

(To Be Continued)

FIRE ALARM KEY

SPECIAL SIGNALS

22 Daily Test Signal at 12 o'clock noon and 4.30 P. M.
33 General Alarm, followed by a box number.
4 Forest Fire. This may be followed by a box number.
12 Chimney or other Small Fire reported over telephone.
21 No School signal at 7.45 A. M.
55 Aid requested by "out-of-town" call.

All persons are warned to comply with the new "right of way" law for fire apparatus and not park within 600 feet of any fire, and also to "pull over" and permit apparatus to pass.

If you do not know how to operate a fire alarm box, ask any fireman and he will be glad to show you. Visitors are welcome at any fire station during the day.

Box	Location	Box	Location
14	Phinney's Boat Shop	34	Quissett and Buzzards Bay Aves.
141	Oak Crest Hotel	341	Hilton's, Glendon Rd., Woods Hole
142	Terrace Gables	342	Nobska Point Section, Woods Hole
143	Vineyard Sound House	343	Fenno's Farm, Quissett
144	Amherst and Grand Aves.	345	Marshall's, Quissett Ave.
145	Turner and Breivogel Garage	346	Quissett Four Corners
15	Tower House	347	School House, Woods Hole
16	Maravista and Grand Aves.	348	Carlton Estate, Woods Hole
17	Hadley's Cor., Davisville	349	Gansett Section
212	King St. and Clinton Ave.	35	West and Milfield Sts., Woods Hole
213	Power Station	36	U. S. Buoy Yard, Woods Hole
214	Queen St. and Nye Rd.	37	Steamboat Wharf, Woods Hole
215	Almshouse	38	Prospect St. and Buzzards Bay Ave.
216	Teaticket Post Office	39	Penzance Point Section
217	Trotting Park Rd.	41	East Falmouth
23	Palmer Ave. and Morse Rd.	412	Kenyon's Corner
231	Sippewissett and State Rds.	413	Fuller's Corner
232	Palmer and Oakwood Aves.	414	Brick Kiln and State Rds.
234	Gifford St. and Morse Rd.	415	Brick Kiln and Sandwich Rds.
235	Queen's Buyway	42	Menauhant District
24	Falmouth National Bank	43	Waquoit District
25	Wood Lumber Co.	432	Fresh Pond District
251	Falmouth Railroad Station	45	West Falmouth District
252	Elm Rd. (The Moors)	46	North Falmouth District
253	Surf Drive	47	Megansett District
26	Grammar School (Village)	48	Silver Beach District
27	Main and Walker Sts.	49	Hatchville District
28	High School	492	Ashumet District
32	Hose No. 5 Station, Woods Hole		
324	Gunning Point District		
325	Sippewissett Hotel		
326	Quissett Harbor House		

Our Authorities

Dr. Edwin G. Conklin is professor of biology at Princeton University, and a member of the National Academy of Sciences.

Dr. Oliver S. Strong is professor of neurology and neurohistology at the College of Physicians and Surgeons, Columbia University.

Dr. Samuel E. Bond is assistant professor of physiology at the University of Pennsylvania. He is in charge of the apparatus department of the Laboratory.

Dr. W. L. Dolley, Jr., is professor of biology at the University of Buffalo.

Dr. Alexander Forbes is associate professor of physiology at the Harvard University Medical School.

Dr. B. M. Dugger is professor of physiological botany and economics at the University of Wisconsin.

Dr. William Crocker is director of the Boyce-Thompson Institute for Plant Research.

Apparatus Accumulates at Barely Burning Blaze

History was made in this humble little town on the afternoon of Friday, July 8. No inauguration could have been more impressive, although most of the inhabitants of the sleepy village were hardly aware of the significant event occurring within their midst.

At 5.48 the unceasing calm of a scientific community hung over Woods Hole. Hardly a starfish crawled in the laboratory, hardly an eel wiggled in the pond. At 5.49 the deep-throated voice of an alarm threatened the peace and quiesence of the locality with the dread menace of fire. The signal tokened the schoolhouse district which lies in the remote suburbs of the town, and therefore, few from the Laboratory felt able to follow the fire department as it thundered forth, but curiously scanned the sky across the Eel Pond. Disappointed not to see the sky alight from the glow of the flames they returned to the dead monotone of research, while at the scene of disaster history was written for Woode Hole.

The Collecting Net correspondent is able to report *authentically*, much as it may startle the readers of this weekly, that the new Woods Hole fire pump was actually put into operation for the first time. According to Mr. Ferris, permanent head of Station 5, an authority, the apparatus undeniably worked, pumping great streams of water to quell the blaze which lurked in the depths of the Stevenson House cellar.

As if to make the occasion more inspiring the Falmouth Fire Department lent the glory of two engines and a hook and ladder to augment the sturdy Woods Hole pair, and together with Fire Chief Ray D. Wells' private machine made a total of five pieces of apparatus.

The traffic tie-up threatened to be serious on the Falmouth road. Care were blocked in a jam difficult to manage because of the presence of the entire canine and small boy population.

Some of those fortunate enough to see one or two billows of smoke (the correspondent among them) and noticed firemen pouring chemicals down the chimney realized that a small pile of blazing newspapers in the cellar had caused the initiation of the shiny red and silver pump of which Woods Hole is rightfully so proud.

Horseshoes in Full Swing Among Old Hands

The newcomer at Woods Hole is not infrequently heard to inquire whether the Laboratory boasts a blacsmith shop in addition to its other adjuncts. This query seems sometimes to be prompted by the discovery of a collection of horseshoes neatly parked on the rear wall of the Old Main Building but is doubtless more often occasioned by the fact that at almost any hour of the day from dawn till dusk a curious clinking sound, as of hammer on anvil, may be heard by anyone wandering within half a mile of the Laboratory.

To the initiated, however, this sound conveys merely the knowledge that the "old-timers" are at it again in the horseshoe pits. It means in all probability, especially if it be heard at the noon hour, that "Art" Dawson is tossing double-ringers or that "Sturt", with pipe firmly clutched between teeth, is exhibiting that Hermes-like pose that characterizes his follow-through. Or perhaps it is "Mart", that splendid exponent of scientifically cautious procedure in the realm of horseshoe pitching. Yes, nearly all of last season's headliners are with us once more and may be seen limbering up daily in preparation for the annual ladder tournament which will soon be in full swing. Dr. J. A. Dawson, last year's winner, is on hand to defend his crown, and his runner-up and time-honored rival, Dr. O. L. Inman, is once more out to make a serious bid for the championship. Each is said to be playing a strong game and the battle should be a keen one. In addition to these, Lancefield, Swett, Sturtevant Wilson, and a host of others, any of whom may prove the "Dark Horse of 1927", may be observed so frequently in action that one is led to predict a year of activity totally without parallel in the annals of M. B. L. horseshoes. Victoribus sunt praemia!

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THE PERMEABILITY OF THE CAPILLARY WALL

E. M. LANDIS
University of Pennsylvania

Mr. Landis delivered a lecture bearing the above title on the evening of July 15. The author's summary and a review of the paper follow.

The methods used in the study of the passage of water and dissolved substances through the capillary wall have been for the most part indirect in character, and have involved large numbers of capillaries. The interpretation of results obtained in this way is difficult because of the continually changing diameter, pressure, and rate of flow in the separate vessels which compose the capillary network. These variables can be reduced in number and more adequately controlled by studying single vessels, which limits observation to what is in fact the unit of fluid interchange.

A micro-injection technique was used for the measurement of systolic, diastolic, and mean blood pressure in single capillaries. The results indicated the existence of a balance between capillary blood pressure and the osmotic pressure of the plasma proteins. The level at which this balance occurred was higher in the rat, a mammal,

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Review

BY DR. A. P. MATHEWS
Professor of Physiology, University of Cincinnati

It is well known that between the ends of the arterioles and the veins of the body there is to be found a network of very fine blood vessels of which the walls are a single cell in thickness. These vessels are the capillaries. It is through the walls of these vessels that all the food matters brought by the blood must pass to the tissues; and the waste and other products of the chemical activity of the tissues pass back to the blood. The question of the nature of the processes involved in this passage outward and inward in the tissues has been investigated for many years, and opinions have been divided whether it is wholly a physical process of osmosis, the capillary wall playing a wholly passive part, or whether it is in reality a vital process, the physical play of osmotic forces being controlled and regulated by the vital activity of the living cells of the capillary wall. The analogous problem in the lungs, of the passage of the oxygen into

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M. B. L. Calendar

Saturday, July 23
9:00-12:00 P. M.

Club Dance. Orchestra. M. B. L. Club. Admission free to members; 75c for non-members.

Sunday, July 24
9:00 P. M.

Informal Singing. Roof of Brick Building if the weather is good. Otherwise the group will gather upstairs on the M. B. L. Club porch.

Tuesday, July 26
8:00 P. M.

Evening Lecture. Dr. Robert M. Yerkes, Professor of Psychology, Yale University. **Subject:** "The Psycho-biology of the Gorilla".

Friday, July 29
4:00-6:00 P. M.

Physiology Tea. M. B. L. Club.

Friday, July 29
8:00 P. M.

Evening Lecture. Dr. Henry Bigelow. **Subject:** To be announced later.

RESEARCH IN COLLEGES

An informal conference in regard to research in colleges will be held in Room 130, Brick Building, at 8.00 P. M., Thursday, July 28. Brief accounts of conditions in a few institutions will be given, accompanied by a general discussion. This meeting is called in accordance with the vote passed at the similar conference held last summer. All interested are invited to attend.

CILIA AND CILIA

The Protozoology class assembled the twenty-eighth of June with the serious intention of pursuing the elusive Protozoan. A collecting trip was inaugurated immediately after a lecture by Dr. Woodruff, who gave the class a general idea of the Protozoan. Lillie's Ditch, Dump Pond, School House Pond, and various other future bases of supply were visited. The afternoon's work settled down to trying to find what the books so accurately describe.

This tale would, from now on, be mere repetition of lecture and laboratory, were it not for the variety in lectures and the learning curve in the laboratory work.

The lectures describe the biological background beginning first with the origin of the microscope, from simple lenses to those that finally led to the manufacture of the present day masterpiece. Indeed as the automobile was popularized by Henry Ford so was the microscope popularized by Robert Hooke's "Micrographia," Henry Baker's works, as well as those of the two Adams, father and son.

Microscopes are of little significance unless the men who use them correlate the results of keen observation. Leeuwenhoek, a man of no formal education, observed the organisms which we today recognize as

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Currents in the Hole

At following hours the current in the hole turns to run from Buzzards Bay to Vineyard Sound:

	A.M.	P.M.
July 23	11.45	12.00 m.
July 24	12.40	10.04 a.m.
July 25	1.40	2.00
July 26	2.40	2.50
July 27	3.40	3.40
July 28	4.20	4.40
July 29	5.15	5.15
July 30	6.00	6.10

In each case the current changes six hours later and runs from the Sound to the Bay.

FISH COMMISSION WAS ONCE HOUSED AT LITTLE HARBOR

"Reminiscences of the Fish Commission"

DR. EDWIN LINTON
Honorary Research Fellow in Zoology, University of Pennsylvania

I. Baird at Woods Hole

In consenting to write a series of articles on his early days at the Fish Commission, Dr. Linton is undertaking a task which will be appreciated by everyone at the laboratory.

I have been asked by the Editor of *The Collecting Net* to write out some of my recollections of events connected with the United States Fish Commission Laboratory at Woods Hole. In complying with this request I shall make, for my first contribution, an unpublished address which was delivered at the Baird Centennary Celebration, in the auditorium of the United States National Museum at Washington, D. C., on February 3, 1923.

Seven years ago, lacking but six days, it was my honor to have a place on the program of exercises attending the unveiling of a memorial tablet to Spencer Fullerton Baird, on the forty-fifth anniversary of the establishment of the United States Bureau of Fisheries.

My contribution on that occasion was an appreciation of Professor Baird (Science, N. S., vol. 48, pp. 25-34), in which appreciation stress was laid on his power, through a simple, persuasive eloquence, which was peculiarly his, to convince those who were then in charge of public affairs, of the vital importance to the nation of scientific inquiry.

The creation of such an organization as the National Research Council, in the early decades of this century, may be looked upon as a natural development of ideas concerning the public welfare which dominated the mind of Professor Baird in

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"The Chemical Room"

Its Past and Present

Dr. Oliver S. Strong

Professor of Neurology and Neuro-Histology, College of Physicians and Surgeons, Columbia University.

This is the third installment of Dr. Strong's article on the development of the Chemical Room.

The Chemical Room is under the general supervision of the person designated Chemist in in the Announcement of the M. B. L. This person, in consultation with the Director, (a) appoints the staff, (b) determines the general nature of the management (rules, division of labor, etc,), (c) determines the arrangement of the supplies in the room and any physical changes needed, and (d) orders all supplies. If absent, the general charge of the room and making the emergency orders then devolve upon a member of the staff designated by him as acting in charge. Upon the other members of the staff devolve the actual care, placing, distribution and return to their places after use, of the supplies, and making up various solutions as indicated above.

Chemical Room Appointments Popular

Regarding appointments to the staff a few words may not be amiss and may be of practical use to some readers of this article. Those wishing positions in the Chemical Room are requested to make application in writing to the Chemist, stating their qualifications, about when they expect to reach and leave Woods Hole and whether they prefer to work whole or part time. The actual distribution of time depends upon the varied needs of their services. Preference is given to those who have previously served with satisfaction and to those who wish to do research work. While training in chemistry or biology is desirable, it is not necessary in all cases. It may be remarked that the Chemical Room affords working space for those members of its staff who desire to carry on personal research and that such members have the same facilities and privileges (supervision by older investigators, lectures, library, use of apparatus and so forth) as the investigators. In fact the general aim in filling positions in the Chemical Room is not only to provide efficient service but also to afford opportunity for its staff to avail themseves of the general scientific advantages of spending a season in Woods Hole. Private rearrangements of time among the members of the staff are permitted provided that the efficiency of the service is not in any way impaired, that the total amount of pay is not increased, and that the pro rata

(Continued on Column 4)

"The Chemical Room"

payment per hour of services is not increased. Chemical Room positions have always been popular in the past and the necessity of keeping new applicants in suspense until it can be learned what members of the previous staff propose to return, together with the selection of appointments from new applicants, has proven a problem requiring considerable delicacy of adjustment. It may also be remarked that several members of this years staff, owing to the fact that there have been more applicants than vacancies, have taken positions without pay on account of the general advantages accompanying such positions.

The determination of the amount of time spent by each member of the staff—accomodating this to the varied needs of service, to the desires of the individual, and to the limitations of the budget—is also a matter of considerable complexity, involving, as it does, so many variables. Mr. Wolff recently presented to the Chemist an elaborate card upon which appeared the results of his wrestlings with this problem.

The Process of Ordering

The process of obtaining supplies as it has been worked out in the Chemical Room may be of some interest. There have been provided now for ten or more years two books, one of which is entitled "Supplies Immediately Needed" and the other "Supplies Needed for Next Season". When any member of the staff has a request for a supply not in stock or thinks that some item is running short and more will be needed soon he (or she) notes in the first named book the name of the item in question with further details as to the probable amount needed, quality, catalogue number where possible. and by whom needed, adding his own initials so that further details can be obtained if necessary, when an order is made. The actual order is only made up by the Chemist or by the person in charge of the Chemical Room. The order itself is written in a special book provided for the purpose, with the firm to whom the order is to be sent. the date of the order, and all the necessary details about the items ordered. This book is then taken to the Business Manager's office, a copy of the order in duplicate is made, the number of the order is also entered in the Chemical Room book and a copy of the order is sent to the proper firm by the Business Office. When the goods arrive they are checked in the Chemical Room book. In making up an order the catalogue price of each item, or the pro-

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"IMPLICATIONS OF THE ALL OR NONE PRINCIPLE IN THE PHYSIOLOGY OF THE CHEMICAL NERVOUS SYSTEM"

Dr. Alexander Forbes

Associate Professor of Physiology, Harvard University Medical School

Dr. Forbes delivered a lecture bearing the above title on the evening of July 5. The author's summary and a review of the paper follow.

Summary

By Author

The complexity of the nervous system is extreme. Any contribution which makes its workings intelligible is welcome. Some people like complexity, and increase it by inventing new names which may mean nothing. The greatest advances have been those of simplification; e. g. Newton reducing complex motions of the planets to the expressions of a simple law of gravitation.

Keith Lucas made great strides in classifying the functions of nerve and muscle. His work tended toward simplification. It brought out the fundamental similiarity of function between nerve and muscle. Superficially we are struck by their differences; their respective purposes—conduction and contraction—are in contrast; the structural difference is great; as regards heat production and fatigue they differ greatly. But the resemblances are much more fundamental. The laws of electrical stimulation are the same for both, and suggest a common mechanism of excitation. Duration, as well as intensity, is a determining factor in the exciting effect of the current, and the curve correlating requisite intensity with duration has the same shape in both nerve and muscle. On this fact is based Nernst's theory of excitation, which assumes that a certain concentration of ions, caused by the exciting current at a point in the tissue near some semipermeable membrane, is the essential feature in excitation. In both tissues the resulting response is a progressive disturbance marked by lowered electric potential in the active region. Both nerve and muscle depend on oxygen and give off carbon dioxide; both develop heat when active. Both tissues shows a refractory period followed by gradual recovery after response. In both nerve and muscle the response obeys the all-or-none law, which means that the energy of response comes not from the stimulus but from the tissue. There are quantitative differences; in particular the time elements—chronaxie, action current, refractory phase—which are about three times as brief in nerve as in muscle. But the close simi-

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Review

By Dr. McKeen Cattell

Cornell University Medical School

Those who were fortunate enough to be present listened to a most comprehensive and interesting talk on nerve physiology from America's foremost investigator in this field. Dr. Forbesresides on the neighboring island, Naushon, and has spent many summers working in the laboratory.

The opinion was expressed by the lecturer that the more important advances in science are not those which add detail to our knowledge, but rather those of simplification, i. e., discoveries which help to relate and explain apparently isolated phenomena, examples of which are Newton's theory of gravitation, and the all or none principle of nerve and muscle function, the latter established largely from the pioneering investigations of Keith Lucas. Stress was laid on the tendency to emphasize the differences in the properties between nerve and muscle, in physiological teaching, whereas all recent investigations have pointed to a striking similarity in fundamental mechanism governing the action of these tissues. Differences which occur are quantitative rather than qualitative. In this connection the refractory periods, latent periods, speeds of conduction, energy exchanges, the all-or-none principle, etc., were discussed. The demonstration of the essential similarity in the properties of nerve and muscle, he considered to be the most important contribution of Lucas; an opinion which would be disputed by but few physiologists.

The major part of the lecture was devoted to a consideration of the central nervous function in the light of our knowledge of peripheral nerve muscle physiology, with a special consideration of the all-or-none principle. The various points of difference between simple nerve conduction through the reflex arc, as enumerated by Sherrington, were discussed, with especial emphasis on the advances in the understanding of the causes of these differences. Those interested should read Dr. Forbes' recent presentation of the subject in *Physiological Reviews*.

The resonance theory of Weiss came in for criticism, and de-

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Choral Club Organized; Plan to Give Concert

Last August a group of Laboratory people interested in music met to discuss the possibilities of singing a step beyond "Sweet Marie" and "Abdul-a-bul-bul Amir". Their noble purpose has been realized in the Woods Hole Choral Club, an organization of forty members which meets on Tuesday and Friday nights at nine o'clock to recuperate from the lectures.

The organization is unusually fortunate in having for its leader Mr. Ivan Gorokoff, director of the Smith College Choirs, and late choirmaster at the Russian Cathedral at New York.

A public concert is contemplated for the middle of August, but the exact date has not yet been arranged. At this time Woods Holers will have an opportunity of welcoming and encouraging this new organization.

Forbes' Summary

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larity in all the above properties shows that the response is of essentially the same nature in both tissues. It is probably a development of something inherent in primitive cells.

Lucas' work also helps to form clearer pictures of the workings of the nervous system as a whole. The older literature treats "excitation" loosely as if it were a continuous stream poured through a nerve as through a pipe, graded in intensity by the strength of stimulus as by a faucet or throttle. The fact that in axons, at least, the stream is made up of individual response whose size depends not on the stimulus but on the degree of recovery from a previous response calls for an important revision of the older pictures of reflex activity. The idea of graded synaptic resistance must be modified, and the selective effects ascribed to temporal sequence of impulses instead of to graded intensity without reference to sequence.

Sherrington's earlier work emphasized the purposive and coordinating nature of spinal reflexes. More recently, since the newer conception of the nature of nerve response has been available, he has dealt more with the analysis of reflexes. With the aid of isometric recording he has found much about the sequence of volleys of individual nerve impulses involved in the limb reflexes.

The question of synaptic function is unsettled. Sherrington enumerated the salient differences between conduction in the nerve trunk and in the reflex arc, and he gave reasons for ascribing the properties of the reflexes to the synapse. The extensive branching and redistribution of impulses in the gray matter is also an important feature in the reflex.

Lucas raised the question whether reflex function might be built up of responses fundamentally like that of the nerve trunk, and whether the postulate of a special type of function in the synapse might be superfluous. He showed how a certain type of summation in the nerve-muscle preparation and the Wedensky effect might provide a basis for explaining reflex summation and reflex inhibition—two of the most distinctive functions of the reflex arc. Sherrington has suggested that the synapse may differ from the axon in having a capacity for graded and cumulative activity. This view facilitates the interpretation of reflex behavior, and both the "local excitatory process" and mechanical summation in mhsrle provide counterparts in peripheral tisshes for these asshmed properties of the center.

In any case the all-or-none principle leads to important generalizations. If it is dltimately shown that all the activity of the nervous system, not only in the axons but also in the synapses, is made up of a single type of disturbance, it will be a generalization as important to neurology as that which explains all atomic masses on the combinations of protons is to physics. Even if a distinct type of function must be postulated for the synapse, the recognition of unit impulses in the axon is almost as clarifying a generalization.

Cattell's Summary

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servedly so in its present form, nevertheless, the reviewer feels that the question of the effect of rhythm on sensation and motor function warrants further investigation. We have evidence that, under certain conditions, the frequency of the impulse bears an important relation to the effects produced, for example in conditions giving Wedensky inhibition, and when one impulse travels in the subnormal phase of the preceding one. Recent work from Adrian's laboratory has demonstrated that the rhythm of individual nerve fibers varies with the strength and duration of the stimulus, and it can be hardly questioned that these changes of rhythm are responsible for changes in the sensations. On the motor side it can readily be demonstrated that the rate of stimulation modifies the degree of summation produced in muscle. It seems, therefore, not unreasonable to suppose that reflexes may be modified in some degree by changes in the rhythm of central discharge, and such a conclusion in no way invalidiates the all-or-none principle.

It has been customary for the speakers in the evening lecture series to give some of their own investigations, and it was a disappointment to the reviewer that Dr. Forbes did not draw upon his own wealth of material and describe investigations now in progress. It must be remembered, however, that the physiologists form but a small minority of the Woods Hole group of biologists, and it may be that a better purpose was served in giving a less technical talk which was of general interest to all members of the labora-

Reminiscences of the Fish Commission

(Continued from Page 1)

the middle decades of the past century.

If the same wisdom and success, which characterized Professor Baird, in initiating, and carrying through projects for the nation's welfare, attend the activities of the Council, those who look for an honorable and prosperous future for our country are in a fair way of seeing their expectations realized.

The topic which has been assigned to me in these centennary exercises is "Baird at Woods Hole."

I have already put on record some of my recollections of those days (Science, N. S., vol. 41, pp. 737-753), and am naturally tempted to draw upon them on this occasion. I shall endeavor however, in trying to interpret my impressions of those cross-sections of time in which I had the rare privilege of associating with the man whose memory we are now met to celebrate, to make but little direct use of those reminiscences.

Professor Baird's acquaintance with Woods Hole began as early as 1863. In 1870 he made a systematic beginning in the study of Vineyard Sound and adjacent waters, with the object of ascertaining the facts respecting the reported diminution in the supply of food fishes.

In this preliminary work he made much use of the local knowledge, and untiring co-operative labors of Vinal N. Edwards. Vinal lived to take part in the ceremonial of the unveiling of the tablet to the memory of Professor Baird, and for a few years after. Among the relics of the early days of the Fish Commission which he kept in his room in the laboratory of the Bureau of Fisheries, was a pair of shoes which Professor Baird had worn when he and Vinal were making collections.

As I knew Vinal, his mind, it seemed to me, mirrored with surprising accuracy, and in detail, the moving panorama of nature, the changing tides, the shifting winds, the flight of birds, the migration of fishes, from Narragansett Bay to Monomoy. Professor Baird had great confidence in the accuracy of Vinal's knowledge, and I am inclined to attribute much of his acquired worth to the education which he received through his association with the Professor.

In the early days of scientific inquiry into problems relating to the fisheries which it was desired to solve, Woods Hole was chosen as the place to begin. That was in 1871. Professor Verrill writes me that they did their work with a sail boat and a worn out steam launch. However meagre the equipment may seem, when it is compared with what it was ten years later, there can be no criticism, other than commendatory, of a scientific staff with Professor Verrill in charge.

In subsequent years headquarters were established at various points on the coast, from Naank, Connecticut, to Eastport, Maine, and, for a part of the summer of 1877, to Halifax, Nova Scotia. In 1875 Woods Hole was again the headquarters. After that season it was not until 1881 that return was made to Woods Hole, which thenceforth became the center of activity for such scientific investigation as was carried on by the Fish Commission in the summer time on the New England coast.

The reasons which Professor Baird gave for his choice of a site for a permanent laboratory have often been quoted, but are entitled to a place here:

> A totally different condition of things was found at Woods Hole where the water is exceptionally pure and free from sediment, and where a strong tide rushing through the Woods Hole passage keeps the water in a state of healthy oxygenation specially favorable for biological research of every kind and description. The entire absence of sewage owing to the remoteness of large towns, as well as the absence of large rivers tending to reduce the salinity of the water, constituted a strong argument in its favor, and this station was finally fixed upon for the purpose in question.

It is worthy of note that this choice of a location for a biological laboratory was approved by the founders of the Marine Biological Laboratory, which began a work in 1888 that has made Woods Hole familiar to biologists the world over.

Great power was given to the Commissioner of Fish and Fisheries at first, since the heads of the various executive departments of the government were required to furnish to the Commissioner any assistance that it was in their power to render. We, therefore, saw something of the machinery of the Federal Government at Woods Hole. For example, until July, 1885, the laboratory was in a building on the wharf in Little Harbor belonging to the Light House Service. Moreover, the officers and crews of all the steam vessels of the Commission were on the pay-roll of the Navy. The power that was thus placed in the hands of the Commissioner was sufficient to have turned the heads of some men, but, so far as my observation extends, I can testify that Professor

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Cilia and Cilia

(Continued from Page 1)

Protozoa and Bacteria. Ehrenberg in the early nineteenth century saw everything that we see today. However he misinterpreted the thesis forms in terms of Metazoan morphology, even in terms of bewhiskered physiogomy. He did, however, add a certain degree of dignity to the embryonic science of Protozoology. Dujardin originated ideas diametrically opposite to Ehrenberg and gradually supplemented the Metazoan interpretation.

To leave out Schleiden and Schwann, whom the "prep" student knows in connection with the cell theory, would slight the ever increasing history of Biology. We shall take the leap of a span of years to Butschli, who is considered the greatest student of the Protozoa because of his application of Protozoology to the clearing up of other problems. His summaries are considered excellent. In the latter part of the nineteenth century Kent did very good work on the Protozoa, but it did not come up to that of Butschli.

We must not leave out Stein of the late seventies of the nineteenth century, who is noted in our laboratory for his three volumes. An initiated hearer might suspect our group of pre-Volstead tendencies to hear the frequent demand for "Stein's".

July 14, 1927 Dr. Wenrich of the University of Pennsylvania delivered a talk about the interesting vicissitudes of the parasitic amebae. Modestly disclaiming any authoritative knowledge he proceeded to give us a thorough talk including six "good" species. A seventh species was mentioned and logically eliminated.

The leatning curve is reptile with "despond" plateaus. The first two as three days show no rise in altitude. Cries of "Hurry up, lend me your ocular micrometer," are interspersed with sighs of disappointment as the Metabolic Protozoa depart. "Diagnostic features" is our motto until at night in our dreams we see nothing but cirri and membranelles. We become cilia and cilia, wishing that Euplotes Charou would carry us across the River Styx to the land where everyone has identified one hundred species, past Cerebrus's watchful eyes, who hands us back our "masterpieces" as "not diagnostic."

EMBRYOS

One half the course is over and we are still going in circles. An order has gone to New Bedford for thirty compasses—Why can't eggs be square? But still it must be remembered that pies come in circles as well as eggs —also blueberries. Between Dr. Goodrich and Dr. Rogers the pie soon disappeared as the lab floor took on a new coat of paint.

With the beginning of experimental work on Echinoderms there came a general exodus of glassware from the cupboard and a corresponding lack of room for further activity. But it's worth it if we can just shake apart a few Starfish blastomeres. We've taken to the centrifuge like children to a new toy. We know just how to diagnose its wild groans.

If anyone needs ribbons matched to dresses she is urged to apply at the Embryology lab. Experts in matching colors are being ground out there every hour. Before long we'll be finding the pH of that glorious henna in Arbacia eggs.

Dr. Clarke, "the tadpole's tailor", gave a fascinating lecture on the *Growth and Expansion of Cells in the Tail of the Tadpole.* Friday Dr. Rogers entertained us with a lecture on the development of the star fish which he illustrated most elaborately with colored clay models. Saturday, Dr. Plough reviewed his recent experimental work on localization in Echinoderms. This week we are studying Molluscs.

Landis' Summary

(Continued from Page 1)

than in the frog, an amphibian. In both forms the average gradient of pressure fall along the capillary network was related to the colloid osmotic pressure in such a way as to permit filtration in the arteriolar portion of the capillary, and absorption in the venous portion, tending therefore to maintain a constant blood volume.

This balance between capillary pressure and the osmotic pressure of the plasma proteins strongly suggested, but still did not specifically prove, that this was the true mechanism involved in fluid movement. It was possible, however, to study directly the relation between capillary pressure and the passage of fluid through the endothelial wall. When blood flow through a single capillary in the frog's mesentery was stopped the corpuscles at the free extremity in some instances moved toward the closed end, indicating filtration; in some away from the closed end, indicating absorption; and in others the corpuscles remained in their original positions. This movement of the cells at the open end of the occluded vessel was used as a measure of the direction and the rate at which fluid was passing through the capillary wall. The filtering area could be computed from the length and diameter of the capillary. A micro-pipette introduced into the vessel determined the capillary pressure.

At pressures above 14.5 cm. of water filtration was always observed; while below 10 cm. absorption occurred in almost every case. Between 10 and 13 cm. there was little or no movement in either direction. As would be expected from Poiseuille's law, when the rates of fluid movement, measured in cubic micra per square micron of capillary wall per second, were plotted against capillary pressure, they were distributed about a straight line. This intersected the line of zero filtration at a pressure of 11.5 cm. which represented the osmotic pressure of the plasma proteins measured against the capillary wall. Mathematical treatment of the data permitted the computation of a filtration constant. Good agreement was observed between the observed rates of fluid movement and values calculated on the basis of this filtration constant.

Having thus obtained a quantitative measure of normal capillary permeability it was possible to study the manner in which this property was modified under certain experimental conditions. It had been observed repeatedly that active hyperemia produced a rapid movement of fluid from the blood stream into the tissue spaces. This change was usually ascribed to the dilatation of the capillary on the assumption that the stretched capillary wall became more permeable to fluids, and, according to Krogh, even to colloids. But by direct measurement it was found that in any active hyperemia there appeared also a pronounced rise of capillary pressure, which would tend to produce an increased rate of filtration. It seemed of interest to determine which of these factors was the more important.

Experiments involving the perfusion of single capillaries of known diameter, at a known pressure, indicated that the rate of passage of certain dye solutions was related not to the degree of dilatation, but depended entirely upon the pressure at which the perfusion was made. Moreover, direct measurement of fluid movement showed that in capillaries of the same diameter there might occur filtration, absorption, or neither according to the relation of capillary pressure to the colloid osmotic pressure. In addition at any one capillary pressure the rate of filtration remained constant irrespective of capillary diameter. It seems therefore that the increase in filtration which accompanies dilatation of the normal capillary is due not to a change in the permeability of the capillary wall, but to a rise in capillary pressure.

A study of injured capillaries indicated a marked increase in their permeability. Micro-injection showed that the damaged endothelium was quite permeable to highly colloidal dyes and to the plasma proteins. By direct measurement it was found that fluid filtered through the injured wall from six to eight times as rapidly as through normal endothelium. Due to this increased permeability the effective osmotic pressure of the plasma proteins was reduced to less than half the normal value.

In measuring capillary permeability under the conditions which are likely to accompany active tissue function it appeared that, within physiological limits, increase of hydrogen ion concentration and rise in carbon dioxide tension produced no marked change. A lack of oxygen, lasting for three minutes, increased the rate of fluid movement, and lowered the effective colloid osmotic pressure; both changes in all probability being due to an increase in the permeability of the capillary wall. Within certain limits this change was reversible.

It appears from these observations that the direct measurement of fluid movement may be of value as a means of determining quantitatively the modifications in permeability produced by various experimental procedures. It seems also that the importance of local capillary blood pressure, as a factor in fluid movement, can hardly be over-estimated in the quantitative study of the physical processes involved in either normal or pathological capillary permeability.

Mathews' Review

(Continued from Page 1)

the blood and carbon dioxide out of the blood, has, for the moment at least, been settled as a purely physical matter, the lung cells not actively intervening in the process.

In the view of Dr. Landis, who at Dr. Jacobs' suggestion applied the method of micro-injection worked out by Barbour, Kite and Chambers and perfected by the latter, to the study of capillary pressures in the capillaries of the mesentery of the frog and rat, the formation of lymph, that is the passage outward of fluid from the blood to the tissues carrying with it substances in solution, is a purely physical process; as is also the absorption of fluid from the tissues. The capillary wall plays no active part in the process, although if injured its permeability increases and it lets more fluid through and also permits the passage of colloids, such as the blood proteins, through the wall.

The lecturer gave almost entirely the results of his own investigations. These were carried out with great ingenuity and led to the direct determination of the pressure in individual capillaries of the mesentery. He was thus able to show directly the diminution in the pressure in the arterioles and in the capillary network and in the small veins. Many other attemps have been made, with some success, to measure the capillary pressure, and the results obtained by the author confirm in general the results obtained by these other methods but have the advantage that they are direct determinations of single capillary pressures.

The pressure thus found in the capillaries of the frog mesentery was about 11 or 12 cms. of water, a figure in consonance with the work of Krogh. In the rat's mesentery it was higher and of about 25 cms. of water.

It seems remarkable that the pipette thus introduced into the capillary should not have allowed any leakage about the point of entrance, but apparently no such leakage occurred. If leakage had occurred the results would have been to some extent invalidated. The speaker made no direct statement in this regard, but it is to be assumed that so obvious a source of error would have been guarded against.

By means of the measurements thus obtained a formula was derived which permitted the calculation of the amount of fluid passing through a definite area of the capillary wall in a definite time as a function of the difference between the osmotic pressure of the proteins of the blood and the pressure in the capillary. The amounts calculated in this manner and from observations of the movements of corpuscles agreed as closely as was to be expected.

Measurements were also made of the state of permeability of the capillary wall by the injection of dyes of various kinds and the determination of the time required for the dye to pass outside the capillary when different pressures were applied to it. The results were found

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The Collecting Net

A weekly publication devoted to the activities of the Marine Biological Laboratory and of Woods Hole in general.

(Application for entry as second-class matter is pending.)

The Universal Press
New Bedford Woods Hole
Massachusetts

An Apology

We humbly ask the indulgence of our readers for the many and varied errors which occurred in the last issue of *The Collecting Net*. They will not occur *en masse* again. Rather than permit mistakes to creep in with such frequency we will let the number come out on Monday instead of Saturday. But this must not happen, and can be avoided if we send our copy to the printers in sufficient time. The bulk of the material must be in our hands before noon on Sunday so that we can put it on the boat leaving for New Bedford on Monday morning. The remainder of the copy must follow on the early boat Tuesday morning. Short items of importance could be taken care of as late as Tuesday evening, but these must always be limited.

We view with chagrin the condition of *The Collecting Net* for July 16. But we can always see a bright side to the worst situation. What fun it will be to watch ourselves improve, and how much more a perfect number will be appreciated! A day of sunshine at Tuscon is just another day, but a day of sunshine at Woods Hole is *the* day!

The Sad Fate of a Youthful Sponge

(*Tune*: *"John Brown's Body."*)

There was a little blastula no bigger than a germ,
Who performed invagination in his mother's mesoderm,
And soon his nascent cilia with joy began to squirm
In ecstacy supreme.

Chorus: Oh, the joys of locomotion,
Down within the depths of Ocean,
Oh, to feel the great commotion
Within each blastomere.

Repeat after each verse.

No protozoan e'er can guess the pleasure he did feel
As he felt within his ectoderm a growing pastrocoel;
With joy and pride his polar cells began at length to reel
In foolish self-content.

His gastrocoel was filled with pride that comes before a fall,
And he felt his mother's ectoderm to be exceeding small,
So he freed himself from all restraint by rupturing the wall,
And floated out to sea.

But oh, alas for youthful pride, as upward he did soar,
He caught the topmost spiculae upon his blastopore;
And, trying hard to get it off, his ectoderm he tore——
A great, big, ugly rent.

"Oh, Mother dear," he cried in grief, "come quickly now and try
To heal my little ectoderm, or else I'll have to die;"
But his mother dear was sessile, and could only sit and cry
From her excurrent pore.

Now every night his little ghost within the depths is found,
Lamenting to the annelids that burrow in the ground;
The hydroids wave their tentacles and shudder at the sound
Of that familiar strain.

H. H. Wilder.

Amphioxus

(*Tune*: *"Tipperary."*)

A fish-like thing appeared among the annelids one day;
It hadn't any parapods or setae to display;
It hadn't any eyes or jaws or ventral nervous cord,
But it had a lot of gill-slits, and it had a notochord.

Chorus: It's a long way from Amphioxus,
It's a long way to us;
It's a long way from Amphioxus
To the meanest human cuss;
It's good-by, fins and gill-slits,
Welcome, skin and hair;
It's a long, long way from Amphioxus,
But we came from there.

Repeat after each verse.

It wasn't much to look at, and it scarce knew how to swim,
And Nereis was very sure it hadn't come from him;
The molluscs wouldn't own it, and the arthropods got sore,
So the poor thing had to burrow in the sand along the shore.

It wriggled in the sand before a crab could nip its tail;
And said, "Gill-slits and myotomes are all of no avail";
I've grown some metapleural folds, and sport an oral hood,
But all these fine new characters don't do me any good."

It sulked awhile down in the sand without a bit of pep,
Then stiffened up its notochord and said, "I'll beat em yet;
I've got more possibilities within my slender frame
Than all these proud invertebrates that treat me with such shame."

"My notochord shall grow into a chain of vertebrae;
As fins my metapleural folds shall agitate the sea;
This tiny dorsal nervous tube shall form a mighty brain;
And the vertebrates shall dominate the animal domain."

SCHOLARSHIP FUND GETS TEN DOLLARS

Dr. Ralph Cole, owner of "Cole's" store in Falmouth, has made the initial donation to "*The Collecting Net* Scholarship Fund". On hearing about the Fund and its purpose he immediately wrote out a check for ten dollars payable to the Fund. Dr. Cole's donation is appreciated by every one at the Laboratory and likewise his request to "call again next summer for another one".

DIRECTORY ADDENDA

ADDITIONS

Huffes, R., supt., Bureau of Fisheries

To The Collecting Net:

Individually scientists seem to be more or less indispensible to a community—mostly more. Collectively, the reaction seems to be reversible. At least that must be the sad conclusion reached by one who, though far from scientific, knows the difference between fresh, sparkling H^2O and the excuse for water that is perpetrated at Woods Hole. Have you had your iron today? Healthy it may be, but for flatness, tastelessness and color-scheme it is inconceivably appalling.

Isn't there some noble, unselfish scientist who can tear himself away from search and re-searching long enough to bring Woods Hole water back to a state of normalcy? Let him prove that scientists *en masse* are not quite as legarthic and hopeless as they now seem to be, and gain the fervent thanks of one

Unscientific Sufferer.

A MYSTERIOUS SILENCE REIGNS

We have heard absolutely nothing about Mr. Clark and Mr. Cushman and the object of their get-together. The conditions have been diagnosed as "the lull before the storm".

Sentimental Salt

"Wed me, my affinity,"
Fervent Fluorine cried.
Sweet maid Sodium shyly said,
"For you I would have dyad."

Fickle Fluorine falsely fled
With Silly Kate, who jeers:
"Content yourself with old Chlorine—
Shed sodium chloride tears."

Hal Ide, pH. D.

"THE STORY OF WOODS HOLE"

DR. EDWIN GRANT CONKLIN
Professor of Zoology, Princeton University

II. THE BEGINNING OF BIOLOGY AT WOODS HOLE.
(Continued)

Anniversary Celebrated

On August 13, 1923, the Marine Biological Laboratory celebrated at Woods Hole the 50th anniversary of the founding of the Penikese School. A bronze tablet commemorative of Louis Agassiz and the Penikese School was set in a great boulder near the highest point on the island of Penikese and a replica of this was placed in the entrance hall of the Crane Building of the M. B. L. Addresses were made at the semi-centennial celebration by three persons who had been teachers or students at Penikese, namely: Edward S. Morse, David Starr Jordan and Cornelia Clapp as well as by certain officers and members of the M. B. L. All the speakers emphasized the new and fruitful methods in the study of biology which were introduced by the Penikese School.

3. The Annisquam Laboratory and the Inception of the M. B. L.

The Marine Biological Laboratory is the immediate outgrowth of a sea-side laboratory conducted at Annisquam, Massachusetts, from 1880 to 1886 by the Woman's Education Association of Boston, in cooperation with the Boston Society of Natural History. The Annisquam Laboratory was organized to serve the same ends as the Penikese School. Its promotor and director was Alpheus Hyatt, Curator of the Boston Society of Natural History, student of Agassiz and inheror of the Penikese ideal. At first this laboratory was located in half of his own house and later in an old barn remodeled for the purpose. At the end of its sixth session letters were sent out to persons and institutions that might be interested, inviting cooperation in establishing a larger and more permanent laboratory. A preliminary meeting was held at the Boston Society of Natural History in March, 1887, when it was decided to raise $15,000 to found a new laboratory. In the course of the next year about $10,000 was raised and on March 20, 1888 the Marine Biological Laboratory was incorporated. The First Annual Report of the Laboratory says that "differences of opinion as to location, policy, etc., were difficult to reconcile," but Woods Hole was finally chosen because Baird had selected it for the Fish Commission Station after ten years of experience up and down the coast from Eastport, Me., to Crisfield, Md. A small plot of land, 78x120 feet near the Fisheries Station was bought for about $1300 and a two story, frame building 28x63 feet was erected on it, which with its water supply cost about $4000. In this founding of the Marine Biological Laboratory Alpheus Hyatt was the leading spirit and for two years he served as President of the Trustees. Associated with him as founders of the Laboratory we must include three other Penikesians, C. S. Minot, W. K. Brooks and C. O. Whitman and their names, together with that of Agassiz, are now commemorated in the name of the roads on the Gansett Property of the Laboratory.

4. Professor Whitman Accepts Directorship

The next step was to find a suitable director. Professor Whitman of Clark University was finally offered the directorship and accepted, and it is no disparagement of what others have done to say that the character of this Laboratory is due to Whitman more than to any other person. Whitman was in a peculiar sense a product of Penikese. A graduate of Bowdoin College and a teacher of Latin in the English High School, Boston, he got his first inspiration for biological work at Penikese. In his address at the opening of this Laboratory, July 17, 1888, he said, "The Marine Biological Laboratory traces its historic roots to Penikeese. . . .Our minds naturally revert to the old Penikese School." He often referred to Penikese, and its ideals were ever present in his mind and were to a large extent embodied in this Laboratory. As our parents live in us so Penikese lives in the Marine Biological Laboratory.

In his inaugural address at the opening of this Laboratory Professor Whitman clearly indicated what these ideals were. "There is great need," he said, "for a laboratory which shall represent (1) the whole of biology, (2) both teaching and research, (3) the widest possible cooperation of Educational and Scientific institutions. Such a laboratory should not be merely a collecting station, nor a summer school, nor a scientific workshop, nor a congress of biologists, but all of these; an institution combining in itself the functions and features of the best biological institutes in the world, having the cooperation of the biologists of this country, and thus forming a national center of research in every department of biology." Again in his first Annual Report he said: "The new Laboratory at Woods Hole is nothing more and I trust nothing less than a first step toward the establishment of an ideal biological station, organized on a basis broad enough to represent all important features of the several types of laboratories hitherto known in Europe and America. An undertaking of such magnitude cannot be a matter of local interest merely and if it be pushed with energy and wisdom, it cannot fail to receive the support of the universities, colleges and schools of the country."

There was little in the early conditions of the laboratory to justify such high hopes. It began with no assured cooperation, no constituency, a bare building, no library, no private rooms for investigators, only a row boat for collecting and with only two instructors, seven investigators and eight students. What it has grown to you can see for yourselves. I think I do not exaggerate when I say that this Laboratory is probably the very best as it is certainly the largest marine biological laboratory in the world.

LOCALIZATION PHENOMENA IN DEVELOPMENT

Edwin G. Conklin
Professor of Zoology, Princeton University

Dr. Conklin delivered a lecture bearing the above title on the evening of July 12. The author's summary and a review of the paper follow.

Summary

Development, which is progressive, coordinate differentiation, is one of the greatest problems of biology. The mechanism of hereditary transmission, that is chromosomes and genes, is largely known. But the manner in which such hereditary factors influence or control development is largely unknown. To understand any mechanism it is necessary to know what it is as well as how it works; and to understand the factors of development we must know as fully as possible the course of normal development as well as the results of experiments. This is my "apologia pro opera mea".

The facts of differentiation as contrasted with the factors are, first the appearance of different substances and, second the localization of these substances in different cells or parts of cells. The notion that a perfectly isotropic protoplasm undergoes development through the influence of some entelechy or immaterial principle, is on a parity with Kepler's idea that the planets are guided in their courses by supervising angels. The idea that function exists apart from structure, and can cause structure, is as improbable as that an immaterial vision floats around in space and gradually forms an eye around itself. Function is usually a more delicate indicator of differences than is microscopic structure but it is logically necessary to assume that for every difference in function there exists some difference, even though invisible, in structure. Whenever we find differences in the functions of cells or parts of cells, we may safely conclude that an "unlimited microscopist" would find differences in structure also. The polarity or symmetry or pattern of localization of an egg cell indicates differences in both function and structure in different axes or areas of the cell. Differentiation is therefore not some immaterial or mystical process; but consists in the formation of different materials and in their localization during the process of development.

Some eggs are very favourable for the study of localization phenomena because they contain certain granules or pigments which serve as "indicators" of differences in different areas of the protoplasm. These

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Review

By Dr. E. E. Just
Rosenwald Fellow, National Research Council

In a lecture given the evening of July 12th, Dr. E. G. Conklin, Professor of Biology at Princeton University, reviewed some of his earlier work on the egg of Cynthia and reported some results of a recent study on the development of the egg of Amphioxus. The subject of the lecture was "Localization Phenomena in Development". As is the case whenever he lectures, whether it is in the evening or to the class in embryology, Professor Conklin had a large and appreciative audience. Indeed, no lecturer compares with him in popularity—a well deserved popularity which is the end product of substantial contributions to embryology, noteworthy for their painstaking exactness and their demonstration of an unusual capacity for making excellent observations.

It is not the purpose of this review to furnish the reader with an abstract of this lecture; such an abstract the reader will find elsewhere in this issue. Rather, this review aims to present briefly the thesis of the lecture as the basis for a concise statement of the problem of localization.

I.

Visible materials are localized in the eggs of Cynthia and of Amphioxus and this localization may be followed during the progressive differentiation that leads to the formation of the embryo. In the egg of Cynthia some evidence indicates that these visible and variously colored materials take up definite positions in the embryo and that loss or displacement of these materials leads to defective embryo formation. In the case of the egg of Amphioxus, however, evidence for the exact distribution of localized materials as a necessity for perfect development is not so clear. Professor Conklin was very frank on this point. His attitude in thus presenting his data would vitiate adverse criticism by the most captious critic.

II.

Students of embryology know that there are numerous eggs that show no visibly localized areas. Thus, there are eggs, like that of Arbacia for example, which though possessing pigment, oil, and yolk show no differential distribution of these

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BRAND NEW ARRIVAL IN PACKARD FAMILY

Miss Priscilla Adams Packard weight seven and one-quarter pounds, became the daughter of Dr. and Mrs. Charles Packard on Sunday, July 17, at Stratford, Conn. the home of Mrs. Packard's mother. Priscilla and her mother are getting along as well as can be expected. Dr. Packard returned to Woods Hole on Monday evening, July 19.

Conklin's Summary

(Continued from Page 8)

granules or pigments may be merely passive materials that take no active part in the process of differentiation, but "like the shells on the beach they indicate where the tides of life have been." Among such eggs that are particularly favourable for the study of localization are those of annelids, gastropods, cephalopods, ascidians, and amphibians. The study of the living eggs in all of these groups shows that there is a progressive formation of different substances, and a progressive localization of these substances. Experiments on all of these groups indicate that the visible granules or pigments may be shifted about without destroying the localization pattern of the egg. This proves that there is some substance in which this pattern inheres and which does not change its position when the visible substances are moved about. In the ascidians alone, of all groups named, I have found that the dislocation of visible substances does lead to the dislocation of the developing organs, and in this group, as well as in others with "determinate cleavage," isolated blastomeres give rise only to the parts of embryos which they would have produced if they had remained in connection with the other blastomeres.

This "mosaic development" of ascidians eggs is very unlike the results which Prof. E. B. Wilson obtained with the egg of amphioxus 34 years ago. In view of the fact that the normal development of amphixous follows the same pattern as that of the ascidians, I have repeated Prof. Wilson's experiments and have found, as he did, that isolated blastomeres of the two-cell stage give rise to perfect larvae. In a single instance Prof. Wilson found that one blastomere of the four-cell stage gave rise to a nearly complete larva, and in a number of instances I have found the same thing to be true. Therefore the egg of amphioxus although showing the same localization pattern as that of the ascidians, is much more capable of regulation. This may be associated with the fact that the protoplasm of the amphioxus egg is much more fluid than is that of the ascidian egg. After the four-cell stage, regulation of isolated blastomeres never appears in amphioxus and it rarely appears as late as the four-cell stage. It occurs much more frequently in anterior quarters than in posterior ones and in this respect it resembles the egg of Triton as described by Spemann. In conclusion, the egg of amphibians, ascidians and amphioxus have the same pattern of localization. In all of these there is a crescentic area on the anterior-dorsal side of unsegmented egg which goes into the dorsal lip of the blastopore and later gives rise to the neural plate and notochord. In all of these eggs there is an area around the posterior side of the unsegmented egg which goes into the ventral and lateral lips of the blastopore, and which contains all or almost all of the materials which form the mesoderm.

By a series of beautiful experiments Spemann has found that there is localized in the endoderm of the dorsal lip a factor which determines the differentiation of the dorsal organs of the embryo. It is significant that the notochord comes from cells in this region and I have found in ascidians and in amphioxus that the embryo does not grow in length nor differentiate normally unless a notochord is present. Is it possible that notochordal tissue is Spemann's "organizer"? Finally it is generally accepted that although the nucleus is the seat of inheritance materials nuclei undergo no differentiation in the course of development. The cytoplasm on the other hand is the seat of new differentiations. Its polarity, symmetry and pattern of localization are sometimes fixed before fertilization and it is therefore necessary to conclude that the egg alone fixes the pattern of development and that the egg and sperm are not equal in developmental potencies.

Just's Review

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materials except that the pigment granules are at the surface. There are eggs which are, according to descriptions, perfectly transparent. Whether pigmented or not, numbers of eggs show no morphological organization; and indeed, many eggs, except during maturation or through the possession of a funnel (too frequently and erroneously termed a micropyle) in the jelly hull, give no evidence of even their inherent polarity. And the polarity of both egg cells and of adult organisms on the basis of physiological studies, especially the work of Child and his students—the most important modern work in the physiology of development—we cannot dismiss simply by saying that polarity is a species of mysticism.

I have studied Professor Conklin's work most seriously and have leaned on it most heavily in my own studies. I feel safe in saying, therefore, that he would agree that since there are ova that exhibit no localized areas, the mere presence of variously colored materials suspended in the cytoplasm—however definite their distribution to systems and to organs— is not sufficient evidence that such materials of themselves are the cause of that progressive differentiation which we term embryology.

III.

Many of these ova that normally possess no visible localization of materials—for example, those of Chaetopterus, Arbacia, Cumingia, and Crepidula — through centrifuging shows definite stratification: that is, the different kinds of suspended particles of the protoplasm become massed in zones according to their specific gravity. Such eggs develop as normal uncentrifuged eggs, as Lillie first showed, thus contradicting the earlier work of Morgan on Arbacia; as Morgan himself later showed for the eggs of Arbacia and of Cumingia. Conklin's results on the eggs of several gastropods belong here also. It is noteworthy that all these ova except the ovum of Arbacia possess determinate cleavage.

What is more, of centrifuged eggs with determinate cleavage (e. g., Lillie's work on Chaetopterus) the clear portions devoid of granules are capable of development.

IV.

On the basis of these considerations it is reasonable to conclude that the progressive differentiation which is development, is not dependent on visible stuffs in the eggs whether these be pigmented or not, no matter how definite may be their distribution to the germ layers and to the various organs. Progressive differentiation—i. e., development—is inherent in the ground substance or colloidal substratum in which are suspended the granules, spherules, and the like—of mitochondria, yolk, oil, etc. Even in those cases where the variously colored suspended particles take up definite loci in the developing embryo, we have no good evidence that such location is more than casual. The ground substance is real protoplasm; the formed bodies suspended in the ground substance are not protoplasm in the fundamental sense: they are but expressions of the activity of this practically almost homogeneous ground substance. This does not mean that the granules, spherules, etc., whether pigmented or not are mere metabolites — they have, as we know, undoubted functions. But if we are seeking the "cause" of the progressive differentiation, i. e., of development, it is a mistake in the face of the mass of evidence on the other side, to attribute this progressive differentiation to visible stuffs in the egg, however important they may be in a subsidiary way to the main course of development.

It is unfortunate that many workers apparently do not sufficiently appreciate the distinction between the ground substance or colloidal substratum of the cell and the cell body as a whole—that is, the ground substance plus the various granules, spherules, etc., suspended in it. Thus, Wilson speaks of the alveolar structure of protoplasm, meaning by the alveoli, I would guess, the yolk spheres. There is no good evidence that the ground substance is alveolar; or, that it is an emulsion. It would be well, therefore, if we keep in mind that there is this almost homogeneous and almost optically empty ground substance, which, isolated from the visible stuffs in an egg with determinate cleavage, is capable of the developmental process. The localization phenomena in the progressive differentiation which is development, is a problem of the ground substance.

Reminiscences of the Fish Commission

(Continued from Page 4)

Baird exercised this power with consummate tact. The officers of the Albatross performed their somewhat unusual duties with cheerful promptness. As for Captain Tanner, whom I saw in all the vigorous activity of his bluff personality, his support of Professor Baird was enthusiastic, efficient and whole-hearted.

Professor Baird was very sensitive in the matter of appointments. I am quite sure that any one with the name of Baird would have stood little chance of securing a position on the Fish Commission. He even expressed regret that the chief engineer on the Albatross bore that name, with whose assignment as an officer of the Navy, he could not have had anything to do, and who, so far as he, or any one else knew, was no relation of his.

Those of us who did not join the Commission until 1882 missed much of the experience of those who had been associated with Professor Baird in previous summers. Thus, Dr. E. A. Andrews, in a recent letter, speaking of the work at Newport, tells of the shrinking attention which he and others in the laboratory gave to an exhibition of snakes let loose on the floor by the Professor, who talked, most interestingly of the king-snake, and other sorts, meanwhile handling them with familiarity and pleasure not altogether comprehended by his startled audience. This is a phase of Professor Baird, which we at Woods Hole had little opportunity to observe.

The importance of having a permanent laboratory at Woods Hole appealed so strongly to Professor Baird, that, when it appeared to be doubtful that the government could be induced to assist in the undertaking, he devised the plan of having the colleges and universities assist by contributing to the purchase of land, on condition that they should have perpetual right to a table, or tables, for the use of students, or members of their teaching staffs.

About this time he enlisted the sympathy of the late Joseph Fay in the project, the result of which was a gift to the general government, for the Fish Commission, of the water front on Great Harbor, running from the property, now owned by the Marine Biological Laboratory, to a point about opposite the western end of the breakwater on Buzzards Bay. Then, somewhat to the Professor's surprise, I think, but much to his gratification, an appropriation was made by Congress which allowed for the improvement of this property. As a result, what in 1882 was a rocky point, soon became the well-appointed grounds of the Fish Commission, with sea wall, basin, pool and pier on the water, and laboratory and other buildings on the landward side, much as they are today.

Dr. Andrews recalls the long consultations which Professor Baird was holding with Professors Verrill and Smith over blue prints of new buildings and a steamship for deep sea work. These were so far accomplished facts by 1882 that plans for them were not much in evidence, so far as my memory serves, although plans for the equipment of the new laboratory were discussed, the designs for which were drawn by Professor Verrill, and constructed under his direction.

The Albatross was planned for deep sea work, and was, and still is, a good sea-going steamship.

Perhaps no one is at fault, and it is doubtless only an incident in the onrush of events in these days of world disturbance, but, when, last summer, I saw the Albatross made fast to the Fish Commission wharf, at Woods Hole, with no crew, either on board or ashore, with streaks of rust on her sides, and with a list to starboard, as if she were downright discouraged, I could not help contrasting her present forlorn plight with the trim appearance which she presented, when, in 1883, with full complement of officers and crew, and with the temporary addition of a small staff of investigators, she made her first dredging trip to the Gulf Stream. I remember too the lively interest which Professor Baird took in this trip, and in the strange examples of the abyssal fauna which were secured.

I do not know what he would think, if he were here, and as he was when the Albatross was new. He gave me the impression of being one who had learned to maintain complete mastery over himself. That he was capable of just anger there can be no doubt, and I think that the present disuse of the Albatross might prove a severe test of his powers of self-control.

(Continued Next Week)

Mathews' Review

(Continued from Page 5)

that when the blood circulation had been interrupted for a few minutes, the capillaries allowed the dye to pass very much more rapidly and would allow even colloidal dyes to pass. Urethane had a similar action. Injury of any kind increased the ease of passage of fluid and colloid through the capillary walls. Simple dilation of the capillaries did not change their permeability, as had been suggested as a possibility by Keogh, although the increased pressure of the blood in the capillary produced by dilation of the arteriole did increase the rate of passage of fluid outward.

The work as a whole is very much to be commended. It is ingenious, thorough and quantitative. It gives us definite figures for the rate of passage through capillary walls which are valuable. It made on the audience a delightful impression, as it was presented clearly and gracefully.

The general result of the work was to confirm an opinion expressed some thirty years ago by Professor Starling, the English physiologist, that the pressure in the capillaries must be large enough to force out of the blood the liquid with substances in solution, against the pressure inward due to the osmotic pressure of the blood proteins. Determinations of the osmotic pressure of the proteins of the blood plasma have shown pressures ranging from 10 to 12 cms. of water in frogs blood. This is just the pressure measured by Landis as the capillary pressure.

While the results thus support the idea that the passage of fluid through the capillary wall is largely controlled by these two mechanical factors of osmotic pressure and capillary blood pressure, as has been generally concluded hitherto, they show also that the state of the capillary wall itself is still more important. This state is referred to by the author in consonance with custom as permeability; but it really means the state of vital action of the wall itself. The capillaries are made of living cells; these cells are innervated. Dr. Landis has shown that the maintenance of their ordinary impermeability to proteins is dependent upon their respiration; and since the fundamental effect of the nerve impulse is to change the rate of the respiration of cells, it may be anticipated that further work will show that the formation of the lymph is controlled by the activity of the capillary cells, although the driving forces may be those of osmosis and capillary blood pressure.

Dr. Landis should bring his results into connection with the work on secretion. It will be recalled that many years ago Heidenhain postulated the control of lymph formation by nerves, and made the assumption that the passage was largely a secretion controlled by special nerves. The reviewer discovered many years ago that if blood is cut off from the salivary glands for a few minutes, readmission of the blood is often followed by the spontaneous and rapid flow of saliva from the gland. Dr. Landis has shown that this process of deprivation of oxygen leads to the increase of passage of fluid through the capillary wall. The natural conclusion is that this may indirectly cause the spontaneous secretion of saliva observed. And if this is so, the control of secretion by the chorda tympani nerve may be largely by its action on the blood flow, in addition to its innervation of contractile elements in the gland.

The admirable work of Dr. Landis illustrates also the great value of the discovery of a method of investigation. Methods developed by Dr. Chambers for the study of cell structure are found to be applicable to the solution of a problem in quite another field. By this method the biologist can study individual capillaries. He no longer has to rely on statistical averages of behaviour of great numbers of capillaries. It is by the study of individuals, rather than by that of populations, that real advance is made in biological work. It is this power of studying individuals which gives the biologist his great advantage over the physicist and chemist, for both the latter branches of science are forced, in nearly all cases, to study great populations, and to rely on statistical methods which show only what the average conduct will be and never what any single individual molecule or atom or electron or individual will do. Perhaps when the physicist is able to study the behaviour of an atom he will find it showing all the indications of possessing mentality and exercising choice, which the biologist finds in every living thing whether that be the cell of a capillary wall or himself.

OUR BACIA

What we are doing in Physiology may be summarized as follows:

For the first two weeks we averaged nine lectures a week; now we have one a day, at nine o'clock. Professor Michaelis of Berlin and Johns Hopkins has been lecturing on physical chemistry as applied to biology. Almost everyone who can manage it comes to hear him, but since there are some who cannot, a summary of his lectures may be of interest. First he treated the periodic system in a striking fashion, valence, interactions of elements all standing out in their relationship to it. Next the mass law. The "K" of all the reactions will be an intimate memory to all of us. Electrolytic dissociations led to "pH", and that to "buffers" and "indicators". Hydrogen and quin-hydrone electrodes were next discussed, then adsorption and surface tension. Ordinary physico-chemical subjects were presented in a most extraordinary manner. Dr. Michaelis continues his course Tuesdays, Wednesdays and Fridays at nine o'clock. Dr. Jacobs or Dr. Fenn lecture on the other days.

Dr. Jacobs' lectures have been equally noteworthy. He has presented over ninety references, (up to the present time), each one succinctly summarized and mostly from recent publications. Such a summary of literature in itself would be remarkable; but he has done much more. He put a vitality into mathematical equations which makes even a Doubting Thomas realize that in biology the mathematical approach is an extremely productive one: calculus, physiology, chemistry, and applied sciences show their intimate relationships.

And the laboratory work, at present under Drs. Jacobs and Haywood, but soon to be under Drs. Fenn and Hartline, is an outstanding feature. One of the class claims unerring accuracy in differentiating the male from the female Arbacia, but the rest go blindly in, making lots of mistakes. Effects of ions, alone and in combination, effects of change of tonicity of the water, and pH bring out the more or less quantitative results. The Amherst instructor rarely gets poor results; others a minority, perhaps, though one of them is now writing, are not so clever and their curves when plotted remind one of the Coolidge angle worms now causing a deep schism in the G. O. P. Don't forget the explanations (not always mathematical) of why the curves were or were not as they should be. The laboratory is rarely occupied between one and six a. m., rarely unoccupied between six and one.

The shades of the arinicola larvae, the neytelus, and the faithful Funduli cry out for a place in this sketch but short shrift must be given them. You all (if we may so address some of the fearless few still reading) know how Fundulus with scales intact can live in either sea or fresh water. This must be seen to be appreciated; also those remarkable chromatophores. As an N. Y. U. Medical School man said: "How did anyone happen to find out that they 'beat' after being put in sodium and then in barium?"

The inability of the duly elected sub-editor to prepare this note for *The Collecting Net* is regretted by the whole class, but by none more than by the

"Anonymous Undersigned".

"The Chemical Room"

(Continued from Page 2)

bable price, is also noted in the Chemical Room book. This enables the Chemical Room to keep track of the general amount out against it even though not corresponding exactly to the final bill prices. When the bill comes in it is of course compared with the items in the Chemical Room book, the bill prices are also added and the bill itself along with the name of the firm, order numbers, date and total amount is entered in another place in the same book.

When an order comes in, besides being checked off as received in the order book, the date of receipt, in the case of chemicals, is stamped upon the label and the label and stoppered end is dipped in a mixture of melted soft paraffin and beeswax. This is also done to most reagent bottles each time after the bottle has been opened during the season.

The above named orders are termed "Emergency Orders". In contra-distinction to them there are orders made up in advance of the season, based upon the probable needs for the coming season. Such orders are known as "Winter Orders". Data for these orders are obtained from entries in the book entitled "Supplies Needed for Next Season", from inspection of the emergency orders of the season and from a careful inspection of the stock at the end of the season. Entries are made in above book during the season by any member of the staff. From these data a list is made up with estimated prices and forms the basis of the winter orders. In placing these orders, certain standardized articles, the prices of which are fixed, are ordered from a suitable firm with which the laboratory deals most extensively. In the case of other supplies quotations are obtained from several firms and the orders are placed on the basis of these. In all cases quotations are obtained before an order is placed whether there is competition or not. When these orders reach the Laboratory they are of course checked off on the invoices and the goods placed in the proper places in the Chemical Room, bottles of chemicals being first dated and treated with paraffin wax as previously indicated. When the bills come in their prices are of course compared with the quotation prices in the usual way. At the beginning of the season all the bills for emergency orders with their amounts etc., but not their items, are entered in the above mentioned Chemical Room order book. These, with the subsequent emergency order bills entered there, not only enable the Chemical Room to easily keep track of its annual expenditures but furnishes a reasonably accurate basis for a tabulation of the amounts spent for chemicals, glassware, etc., (excepting the apparatus now under the charge of Professor Pond). It was from such data that the expenditures for each year since 1910, given earlier in this article, were based. It may be of interest to note in passing that the Chemical Room has had dealings with about seventy-five to one hundred firms in its past history. In the early days the old firm of Bausch and Lomb received considerable attention but now for many years past the fine old German firm of Eimer and Amend of New York seems to hold first place, with an honorable mention of the Arthur H. Thomas Company of Philadelphia and the Fisher Scientific Company of Pittsburgh. The above applies especially to glassware etc. In the line of chemicals we find still on the shelves many bottles labeled Kahlbaum, all pre-war, together with much from J. T. Baker, Eimer and Amend, Merck, Eastman Kodak Company, not to mention a number of others. In the case of certain kinds of supplies, the policy has been pursued, when filling in emergency orders, of ordering extra amounts. This has resulted, in the case of dyes, in building up a fine stock of the Grubler dyes, there being in the neighborhood of two hundred on the Chemical Room list.

(To Be Continued)

JELLY FISH

On July 28 some 50 odd students assembled in the Invertebrate laboratory to learn all that the catalogue promised. For you who are further interested, we refer you to the 1927 announcement of the Marine Biological Laboratory. The routine of lecture and laboratory work has been broken by five field trips so far. These are by far the most interesting features of the course. By this means the students get first hand information as to the habitat and habits of the animals they are studying. This is really invaluable to some of our budding professors of Invertebrate Zoology.

The first trip was Dr. Dawson's Paradise, for we went on a protozoa hunt. As the class is very large we divided into two parties, one going out in the vicinity of Nobska with Dr. Young, and the other to Penzance with Dr. Dawson. (Note: Wear your seven-league boots when going with Dr. Young or you will find yourself somewhere in the rear). You cannot fool Dr. Dawson when it comes to protozoa. All attempts to present unidentified forms failed.

Many of the newcomers to Woods Hole decided after a visit to the Cedar Swamp and the Sphagnum Swamp that field trips are no joke, but must be taken in a humble spirit for one never knows when the fall is going to come.

At Quisset we went on our first salt water collecting trip. Dr. Bennitt enjoyed this for worms were abundant. It really is a help that each tour reveals in abundance a form to make our staff happy and enthusiastic. And speaking of enthusiasm, it is a joy to go collecting with our staff, for they never grow weary of the countless questions and are quite as happy to receive a student's discovery as though it were really something never before seen. Quisset was a rather moist excursion, but clean salt water is no hardship.

Preceding the field trip for July 9, Dr. Young lectured on Phylogeny. This was our first cruise on the Cayadetta, although some went on the Nereis and said that they pitied those on the larger boat. The wharf piles at Vineyard Haven are well covered with *Mytius edulis*, and thanks to the forethought of Drs. Young and Severinghaus, certain fortunate members of the class carried on through the arduous work of scraping pilings with steamed mussels. We were fortunate in getting a very good collection of the animal inhabitants of wharf pilings.

Another trip was taken to Nobska for salt water forms and was distinguished by a few duckings into the salt water. As bathing suits were the accepted costume for this event, no harm was done. The sunburns visibly increased. The prize trip was on Saturday, July 16, when the class went to Hadley Harbor. In his instructions to the class before starting, Dr. Young announced that if anyone was unacquainted with the properties of mud he would not long remain in ignorance. Now all you have to say is "Hadley Harbor" to an invertebrate and he will groan. All joking aside this was the most successful collecting so far and will probably hold the record. One hundred and sixty-five forms were collected and one hundred and three forms were on the demonstration table. The mud flats proved to be most rich in Echinodermata. Dr. Young's team deserves the prize for getting the most forms, the number being about one hundred twenty.

We really do more than go on collecting expeditions, even though this account seems to deal mainly with that part of the course. If you were to drop in any evening at any hour, you would certainly see many students working busily to complete work not finished during regular lab. hours. It is during these times that we get to know each other and much exchange of general information goes on in these informal working periods.

Our Authorities

Dr. Edwin Linton is now Honorary Research Fellow in Zoology at the University of Pennsylvania. He came first to Woods Hole as assistant to Professor Verrill in 1882, and has returned continuously to work here during the summer except for five scattered years when he was working at other biological stations. Dr. Linton was professor of zoology at the Washington and Jefferson College from 1892 to 1922; and almost from the beginning of his research work he has been devoting the larger part of his time to the study of parasitology in fishes. He has concerned himself especially with the life history and distribution of the Helimuth parasites.

Through the generosity of Mr. Henry D. Sharpe, a member of the Corporation of Brown University, a fellowship in biology of $1000 has just been established for the year 1927-1928.

THE COLLECTING NET

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WOODS HOLE, SATURDAY, JULY 30, 1927

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History of Woods Hole Is Theme Used by Artist

It is a far cry from candle works to chromosomes, from guano to science, from whaling ships and British soldiers to yachting rigs and summer boarders—from 1667 to 1927, but Mr. Frank L. Gifford, business man through the week and artist on Sundays, has found that the feel of the old day lingers along with the new—this imported 'Biological'.

For one thing the old house that Ebenezer Hatch built sometime after he came here in 1667 is still standing. In its time it knew Indians, battling Colonists, whaling traders, and a journey to its new foundation on Quisset Avenue, where it is known as the old Knight house. For another thing Mr. Gifford has painted pictures of Woods Hole from the time he was a boy, and he has painted memory pictures of Woods Hole from the time his grandparents knew. He owns pictorial evidence of Woods Hole from 1812, the early pictures painted from his fathers' memory as clear cut now as his own remembrances. A series of these and other pictures were taken to New York this winter, exhibited in the Whitney studios and photographed for various rotogravure sections.

Mr. Gifford's first historical picture is concerned with that appealing incident in 1812 of the British soldiers versus the astute New Englanders, of the famous schooner that was requisitioned by the British. The doughty New England captain ran the boat aground in Little Harbor, and when the British soldiers came for it they were entertained to satiety with gin as effective as the present bootleg variety. And so they forgot their errand.

Little Harbor at that time was fringed with the ten-foot wigwamish looking pyramids that were put over the salt vats on rainy days, when salt was made by drying out sea water,

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M. B. L. Calendar

Saturday, July 30
9:00-12:00 P. M.

Club Dance. Orchestra. M. B. L. Club. Admission free to members; 75c for non-members.

Sunday, July 31
9:00 P. M.

Informal Singing. Upstairs on the M. B. L. Club porch.

Wednesday, August 4
4:30 P. M.

Dedication of a memorial tablet to the late Jacques Loeb.

Addresses By: Dr. Simon Flexner, Rockefeller Institute, Dr. Frank R. Lillie, University of Chicago and Dr. Hardolph Wastencys, University of Toronto.

Friday, August 5
4:00-6:00 P. M.

Tea. Protozoology and Embryology. M. B. L. Club.

Friday, August 5
8:00 P. M.

Evening Lecture. J. Mansfield Clark, Professor of Chemistry, Hygienic Laboratory, Washington, D. C. **Subject:** "A restricted but new approach to oxidation-reduction in the living cell".

DEDICATION OF TABLET COMMEMORATING LOEB ON COMING WEDNESDAY

A ceremony in honor of Dr. Jacques Loeb, who died in 1924, will be held in the auditorium of the brick building on Wednesday afternoon, August 4, at 4:30 P. M. at which time a bronze plaque commemorating his life and work will be unveiled. The plaque will later be placed in the lobby of the building next to the Whitman tablet.

Three short addresses in honor of Dr. Loeb will be given by friends and fellow workers. Dr. Frank R. Lillie former director of the M. B. L. will speak as a representative of the laboratory on Loeb's relation to the M. B. L. Dr. Simon Flexner of the Rockefeller Institute will speak on Dr. Loeb's connection with the Rockefeller Institute, and Dr. Hardolph Wasteneys of the University of Toronto, a former pupil of Dr. Loeb, will discuss his work in physiology. Each of the addresses will be about ten minutes in length.

WHAT IS LIMITING FACTOR IN GROWTH

Size and Number as Related to Organisms

Dr. N. A. Cobb
Nematologist, U. S. Department of Agriculture

Report of an informal evening talk by Dr. Cobb which was given at the Bureau of Fisheries as one of a series of lectures by the Bureau of Fisheries' investigators.

Why not vertebrates a mile long and a thousand feet high? Why not vertebrates only a quarter of an inch long? The known facts clearly indicate limits in both directions. The speaker sketched some of the reasons for the existence of the upper limit, e. g. circulation difficulties due to friction in the blood vessels, accumulation of an excess of excreta during the long journey out and back, the difficulty of maintaining temperature at the extremities; limits set by the strength of materials, bone could not be strong enough or muscles efficient enough to properly support and move so large an organism; food supply difficulties; space limitations connected with protecting such an organism from the elements etc., etc.

Reasons were sketched for the non-existence of exceedingly small vertebrates. The complicated vertebrate mechanism would be in the way in an organism of such small size. Why an elaborate pumping system to pump blood for a distance through which it might diffuse without such a system? So with "centralized" respiration. The competition of such imaginary small vertebrates with other organisms, say insects, of simpler structure better adapted to such small sizes would be a hopeless struggle. Why not insects as large as moles or as small as microbes? Similar sketchy observations were also made concerning the clearly indicated size limits in this group of "lower" organisms.

(Continued on Page 2)

DATE IS SET FOR WATER SPORTS

Annual Natatorial Contests to Be Held Friday, August 5, at 3 P. M.

Mrs. Warbasse Is Sponsor

The annual Woods Hole Water Sports, so long a feature of the summer's activities, will be held again this year under the sponsorship of Mrs. J. P. Warbasse, to whose interest and efforts the success of this event has so many times been due. These contests will be conducted from the Cayadetta float in view of the spectators who will line the shore directly in front of the Laboratory, and will begin at 3 o'clock on the afternoon of Friday, August 5th.

The customary series of events will be run off, with additions and variations. As usual, swimming and diving will be the order of the day, but besides these there will be a Tub Race for junior entries and Canoe Tilts for boys and girls.

It is hoped to make the Relay Races an even more popular feature of the Sports this year than they have been in the past. The various classes will be encouraged to form relay teams, both men's and women's, and the competitive spirit thus engendered among the students should run high. At present no satisfactory scheme for handicapping the Invertebrate team, with its reputed quartet of college swimming stars, has been suggested, but it is rumored that they may have to swim with arms and legs tied behind them. It is hoped that the Investigators may enter a crack team of four against a picked student quartet.

As the Junior events will be called off first starting promptly at 3 P. M., the Senior Swims and Dives will be in order at 4 or shortly after, thus avoiding conflict with the laboratory class work.

A competent corps of judges will be under the leadership of Dr. H. C. Bradley, and the re-

(Continued on Page 11)

Round Table Discusses Copepods and the Nemas

The staff of the Bureau of Fisheries together with the independent investigators and several guests met again for the "Fisheries Thursday Night Round Table" on July 14. This is the second meeting in the series designed to give opportunity for the discussion of the problems of the various investigators and to promote fellowship among the workers. Dr. C. B. Wilson and Dr. N. A. Cobb were the leading speakers, although many joined in the informal discussion which followed the presentation of the papers.

Dr. Wilson, who has spent many years at Woods Hole, and is a recognized authority on copepods, discussed special problems concerning the copepods of the Woods Hole region. Up to 1926 published lists included only about 75 species known from this locality. Dr. Wilson has, however, collected over 300 species already, including parasitic and free-living forms, and has made significant observations concerning their distribution with regard to various ecological factors.

Dr. N. A. Cobb, senior nematologist, U. S. Department of Agriculture, discussed his work on the marine nemas under the title "Size and Number as Related to Organisms". He pointed out the characteristics of marine nemas which make them so well adapted for the investigation of fundamental problems in biology and illustrated, at some length, the development of mathematics as a necessary part of biological research.

An informal social hour followed the more general discussions. About forty persons were present.

What Limits Size

(Continued from Page 1)

Generalizing why not multicellular organisms beyond certain maximum and minimum limits? A little thought shows that limits are set by the relationships of particular mechanisms to the distances involved; and as size, in such cases, is a function of the number of cooperating cells, the limits are *set in numerical terms*. This becomes clearer when we consider our ability to represent a cellular organism by a strictly mathematical (numerical) expression. (The bioequation.) *

The speaker next asked, "Why do we not have cells a meter long and why not typical cells below the limits of a micron or two." Here again reasons were sketched as to why the mechanism of the typical cell would be so complex as to "be in its own way" when the distances involved become sufficiently small and the number of properties to be transmitted sufficiently few.

Size limits in these various cases are set by a fundamental necessity, having its "final" source in the size of the electronic combinations. Particular attention was called to the fact that, usually, the size limits of "adjacent" higher and lower groups of organisms reciprocally overlap (e. g. Vertebrates and Insects), and also to the fact that cells representing individuals of certain species of unicellular organisms are larger than some of the multicellulars, or, to emphasize by reversing, many multicellulars are smaller than some of the larger unicellulars. There is a distinct *lapping* of one on to the size limits of the other.

"Organisms" of Greater Size, "Social Organisms"

Developing a more complex nervous system, the higher organisms have evolved "mental pictures" of distant and invisible things and events, and have invented means for transmitting through various media signs that represent these mental pictures. Thus the social organism evolved. When we speak of the social organism it is usually assumed that we are using analogy, but an interesting formulation might be made out for homology. Are not the interactions between relatively far-distant intellectual organisms, existing in the sea of air surrounding the earth, in many ways actually homologous with the passage of stimuli, etc. in more viscous fluid media between cells? When two very small organisms live in symbiosis, or between cells in blood, or between cells even more intimately organized we have this condition.

The concept of organisms of this higher or social grade suggests the question of there being also lower orders of organisms at the other end of the accepted series. This idea is not new for their existence was specifically asserted by acute observers and adventurous thinkers in the plainest of language at least half a century ago, but at that time the supporting evidence was so meagre that the idea did not rise to the dignity of a working hypothesis. Now it is quite different. Today what we know about certain small living elements, both inside and outside of cells, compels such a working hypothesis, even if we are not already beyond the hypothetical stage.

Here again, size seems a prime determining element. When a cell(really a relatively complex and large organism) transmits its exceedingly numerous properties to its descendants, nothing short of an elaborate census and mobilization is adequate. Hence follow mitosis and its complications.

A cell has, in a great degree, to take care of itself; and so *must* have many of the multitudinous properties characteristic of the groups of cells constituting higher organisms. It *must* nourish itself. "You can take the horse to food, (or vice versa) but you cannot make him eat;—he must do that himself," seems to summarize the situation. If the cell ("eats") assimilates, and is to continue, then it must have mechanism adequate to select, transport, digest, excrete, etc.—at least to take some part in reproducing itself. All this complexity is because of the *number* of characters, and because of the size,—i. e. the distance involved. But what if all these be a hundredfold or more reduced? Plainly, the requirements would call for a simpler mechanism; cell-mechanism would be so complicated as to be in the way.

LITOBIONTS

The speaker had ventured to suggest a general name, Litobionts, for the group of organisms which his observations led him to believe to exist, these very organisms of lower grade; —(litos, simple), simple-organisms. The Litobionts have distinctive properties, such as small size, and simplicity of composition, but nevertheless, live, assimilate, grow, multiply;—not only dividing somewhat after the manner of some higher, more or less filamentous organisms, but *multiplying by endogenous division*, this latter being one of the speaker's own observations.

Yet it is possible to over emphasize the smallness of Litobionts. The speaker stated his belief that we have been looking at Litobionts a long time,—Litobionts of the larger size,—without recognizing their nature, just as observers previous to the time of Schleiden and Schwann had been looking at cells without recognizing their nature. Just as the multicellular and unicellular organisms overlap each other in the matter of size, so the unicellular organisms (having the charcteristic properties of cells as now defined) overlap the Litobionts. There are unicellular organisms smaller than some Litobionts. Or, in reverse, some Litobionts larger than some unicellular organisms.

That the Litobionts are much simpler than cells, is indicated by a number of facts. Their effects on light indicate that in the main, they are composed of a smaller number of kinds of molecules of a more orderly arrangement. The fact that some of them are soluble in reagents, (e. g. acetic acid,) is another indication of relative simplicity. In a word, we must conceive of the Litobionts as made up of a smaller number of kinds of simpler molecules manipulated through very much smaller distances, and therefore necessarily (a matter of "economy", "least resistance") by simpler mechanism. It is quite conceivable that some Litobionts may be smaller than some of the largest molecules. Not needing such large and complex molecules, the mass of the Litobiont may even be smaller than that of some such molecules.

The duality characteristic of all matter leads, however, to an arrangement of the parts in Litobionts such that we can only think of them at present largely in terms of what we know of cell physiology and mechanics: simply because knowledge progresses from the known to the unknown. Our knowledge of cells must be one of the main sources of our Litobiont concepts. We may at least suspect the existence of organisms or quasi-organisms simpler than Litobionts.

(Continued on Page 10)

* Jour. Wash. Acad. Science, June 4, 1925.

ATTENTION TENNIS FANS!

Beach Courts Ready For Play

The work of re-foundationing and re-surfacing the three beach courts of the M. B. L. Tennis Club has finally been completed, and by the time this notice appears it is fully expected that the lines will be laid and that the courts will be completely ready for use.

At considerable expense to the Tennis Club the beach courts, which have always lacked satisfactory drainage, have been raised six inches, complete tile drainage has been installed and a new playing surface applied. As a result, these courts present at all times a dryness of surface that is in marked contrast to their former hygroscopicity. However, until the courts can receive the hardening effect of a couple of days of enthusiastic sunlight, which at present seems almost too much ever to hope for, members are requested to refrain from play following heavy rains when the new and soft surface might easily be impaired.

"THE STORY OF WOODS HOLE"

(Continued)

DR. EDWIN GRANT CONKLIN
Professor of Zoology, Princeton University

III. SOME RECOLLECTIONS OF THE FIRST SUMMER AT WOODS HOLE, 1888

BY CORNELIA CLAPP
Professor Emeritus of Zoology, Mount Holyoke College

I am asked to recall the events and to record some of the impressions received during the first session of the Marine Biological Laboratory at Woods Hole, Massachusetts in 1888.

I had seen the circular announcing the opening of the Laboratory. I was sure that I wanted to see what it was like and to enjoy the advantages of study at the seashore. My memories of the Penikese School to which I went in 1874 quickened my desires and the name of Dr. C. O. Whitman as director added to my interest since he also was a Penikesian.

Thus it was that I arrived at Woods Hole July 10, 1888. I made my way to the building which was to be the laboratory. It was still unfinished. Carpenters were at work making tables, putting up shelves, and doing other necessary last things before it could be occupied for work.

The first man I met was Mr. Bowles, one of the carpenters. From him and from Mr. Van Vleck, a fellow Penikesian whom I met on the street, I learned that Dr. Whitman had not arrived; that he was delayed by illness in his family; that the equipment for the building was still on the road, probably sidetracked somewhere; that it might be some time before the laboratory was opened; that no arrangements had been made for boarding, and that I must look out for myself.

So the search for a boarding-place began. It proved fruitless, for Woods Hole people took no boarders. Fortunately some did take lodgers and there was an eating place at the railroad station. The eating room proved to be a dark, dingy hole where two or three men, who were working at the Fish Commission, took their meals, and there I took my first meals. I found a room temporarily at Mrs. Hatch's house across the railroad bridge, and about this time I heard of a Miss Harris, a student from Wellesley, who had been at Woods Hole and was expected to return in a day or two. A little later Miss Harris and I took rooms at Mrs. Samson's and meals at the railroad station which we gladly left when gardener's cottage at the head of Little Harbor was opened.

This cottage was placed at the disposal of the Laboratory by Mr. Fay. The Marine Biological Laboratory workers took their meals there. Dr. Gardiner sat at the head of the table and often entertained us with accounts of his life in Leipzig. This was the "Mess", so-called from the first; the name originated with Dr. Gardiner. I have very pleasant memories of the table talk and of the associations there. Later I had a room in the cottage for some time.

The laboratory building was becoming more usable every day. It was set down among boulders and the area across the street was strewn with rocks of all sizes through which we made our winding way to the main street near the Stone Building. The way was plain enough by day but it was sometimes a little intricate and interesting when the shades of evening had fallen.

The great lack was the absence of the equipment. Now the Marine Biological Laboratory was an outgrowth of Annisquam Laboratory, which, through the kindness of Professor Hyatt, had been maintained by the Woman's Education Association of Boston from 1880 to 1886. This Association became the instigator of the movement to found a permanent biological station at Woods Hole. The women trustees were those who had been active in the project of a marine laboratory for teachers; one of these, Miss Florence Cushing, was prominent and in many ways efficient. Thus Woods Hole inherited some equipment from Annisquam but not much.

I very distinctly recollect the day when the belated freight car brought our longed-for equipment. Dr. Whitman, Dr. Minot, and I, with the assistance of Dr. William Patton of the Fish Commission, unpacked boxes and barrels of glassware and instruments. It was late in the evening when the last barrel was opened and its contents checked. Then from our arduous labors we repaired to Tommy Howes' ice cream parlor which was just closing for the night and regaled ourselves with ice cream and sherbet.

The Fish Commission was a great advantage to the Laboratory; how great one who was not present that first summer can hardly realize. The Laboratory had no boats, no nets or other apparatus required for furnishing material for study but the Fish Commission had and we enjoyed the benefits thereof. The Fish Commission supplied the seawater for the aquaria. Well do I remember the Fish Hawk and Captain Collins, the skipper of the schooner Grampus.

The men from the Fish Commission used to come over evenings to visit the new laboratory and perhaps to consult our books, for we had in the corner of the upstairs laboratory a few shelves containing the nucleus of our present library. This consisted of some books given by Mrs. Glendower Evans, the sister of Dr. Gardener. Mrs. Evans gave these books as a memorial of her deceased husband and they still bear the memorial book plate which she prepared. And Dr. Minot, I remember, was much interested in the cataloguing and arranging of these books.

That first year there was neither Wilson, nor Morgan, nor Lillie, nor Conklin; they came later.

At the Fish Commission were Dr. Watase, Dr. Ryder, and Professor Patton.

At the Marine Biological Laboratory in the Department of Investigation were:

Dr. E. G. Gardiner, Massachusetts Institute of Technology,
Miss O'Grady, Bryn Mawr,
Miss C. M.. Clapp, Mount Holyoke,
E. O. Jordan, Massachusetts Institute of Technology,
Miss Helen Torrey Harris, Wellesley,
Miss Isabel Mulford (Botany), Vassar,
Mr. Washburn, U. of Michigan.

In the Department of Instruction were:

Charles Atwell, Evanston, Illinois,
James Norton, Ravenswood, Illinois,
John G. Owen, Bridgeton, N. J.
Spencer Trotter, M. D., Swarthmore College, Pa.,
Susan J. Hart, Jackson, Mich.,
C. Walden, Fort Worth, Texas,
Jennie Waldo, Rockford, Illinois,
Caroline Woodman, Lewiston, Maine.

That is, there were seven investigators and eight students. It is interesting to note how many different parts of the United States were represented. Maine sent one student, Texas one, Illinois three, Michigan one, Pennsylvania one, New Jersey

(Continued on Page 10)

"The Chemical Room"

Its Past and Present

Dr. Oliver S. Strong

Professor of Neurology and Neuro-Histology, College of Physicians and Surgeons, Columbia University.

This is the last installment of Dr. Strong's article on the development of the Chemical Room.

The system pursued in the distribution of supplies to investigators and classes is as follows: each investigator and class is provided with an order book, a small book of about six by three and a half inches (known commercially as a pass book, dollars and cents, 40 lines) on the cover of which is the name of the investigator or class and also the building and the number of the room occupied. In this book the investigator, or in the case of a class the instructor, writes a list of the supplies needed stating definitely number, sizes, quantities, formulae if necessary etc. with the date. This may either be hung on the doorknob on the outside of the door of the investigator's room, whence it is collected daily, or it may be handed in at the Chemical Room counter. Short orders are filled immediately when possible and the order book either returned to a rack on the wall just outside the Chemical Room near the counter or taken back to the investigator's room. The rack in question consists of a number of slots with each slot numbered below according to the building and the number of the room. In the case of longer orders which can not be filled immediately, when filled they are delivered to the investigator's room by a janitor and the order book is either returned with the order to the investigator's room or replaced in the rack according to the investigator's wishes As mentioned before thi ssystem was introduced when the Chemical Room was still located in the basement of the Old Main Building. One advantage of this system is that it enables the investigator on his retrun each successive season to utilize the items entered in his order book on previous seasons as memoranda for the order he is making out. When the investigator's supplies are returned to the Chemical Room at the end of the season the articles are checked off in the order book before being returned to their proper places. The writer would like to mention, apparently quite casually but really quite feelingly, *that investigators are prayerfully requested to clean their glassware and see that everything is in order before their supplies are returned to the Chemical Room.* At the close of the season the order books are filed away in alphabetical order, according to the names of the investigators. At the beginning of each season the investigator receives his previous order book or if he is a newcomer a new order book is made out with his name, building and room number. A number of books with the building stamped upon them are already on hand to minimize the amount of this clerical work occurring during a rush period. When each book is given out the name of the investigator is entered on a printed list of buildings and room numbers provided for this purpose and conversely his building and room number is added on a list of expected investigators furnished by the Business Office. This list is typed with intervals after each initial letter so as to provide for additional names in approximately their proper places. The various buildings are indicated by initials and are as follows: Brick Building B. B., Old Main Building O. M. B., Rockefeller Building (the small wooden building formerly used by Jacques Loeb) Rock. B., Botany Building Bot. B., and Old Lecture Hall Building O. L. H. B.

There are naturally a number of details and complications in the management of the Chemical Room which can not be gone into here. There may be mentioned however the General Loan Book, alphabetically indexed in which are entered in the proper places the articles which are given out only for a short time, so that they can be located when needed if not returned immediately. The most hopeless article of this kind is of course the hammer. There may also be mentioned the necessity for a Narcotic Book, the law requiring signed orders for the distribution of certain drugs coming under this head. During the war another somewhat similar book had to be kept for explosives and certain ingredients for the same.

When the Chemist looks back over the history of the Chemical Room it seems as though the process of development, as far as his own activity is concerned, consisted in a successive sloughing off of various duties, their place being partially taken by new more general responsibilities arising out of the increasing size and differentiation of function of the Chemical Room. This process is a familiar one known as the taking up of "executive work". While there is considerable truth in the saying, quoted sometime ago by a famous college president in one of his reports, that successful executive work consists in doing well what might just as well not to be done at all, there does seem to be a necessity for a certain continuity of office on the part of someone to attend to some of the more general functions mentioned earlier in this article. This together with a certain sentimental attitude on the part of the Chemist and a certain easy-going tolerance on the part of the Director probably accounts for the long incumbency of the writer. In this sloughing-off process, what is practically a new official position has risen more and more in prominence and importance. This is the position previously designated the "Person in Charge" during the absence of the Chemist. The initial impulse to this increased importance was due to the enforced absence of the Chemist during the session of the summer school of Columbia University when he began teaching in it some dozen years ago. A much more important cause, however, is the increasing importance of a real chemist in the Chemical Room activities. Among these "Persons in Charge" two names perhaps stand out especially. They are Thomas B. Grave 1920-1925, and Mr. William A. Wolff, the present person in charge. The Marine Biological Laboratory is greatly indebted to their conscientious work, their great interest in the Chemical Room and especially their great development of its chemical activities and usefulness in this line. Providing certain very generally useful standardized reagents may be mentioned as a concrete example. It must however be said in general that the Chemical Room has been very fortunate in always securing the services of a staff of assistants who have been competent and conscientious in their work. The records of the Chemical Room staffs previous to 1915 are not available but the following are the staffs beginning with that year: 1915: W. E. Hoy, Harley Gould, Carl R.. Moore, Humphrey Sugrue. 1916: W. E. Hoy, Carl R. Moore, E. E. McMorland; 1917: Harley Gould, I. J. Davies, Hoyt S Hopkins, Ernest Mahr, Howard Morgan; 1918: I. J. Davies, J. E. Kindred, Howard Morgan; 1919: J. E. Kindred, M. M. Richter, C. C. Speidel; 1920: Thomas B. Grave, Hope Hibbard, J. Burish; 1921: Thomas B. Grave, Hope Hibbard, M. M. Richter; 1922: Thomas B. Grave, Hope Hibbard, G. R. Tracy, Lucile Moore; 1923: Thomas B. Grave, Hope Hibbard, J. B. Lackey, Olga Osterhout; 1924: Thomas B. Grave, Hope Hibbard, Olga Osterhout, Lucile M. Burns,

"The Chemical Room"

(Continued from Page 4)

Mary Dunlap, Mary Closson, Burridge Jennings; 1925: Thomas B. Grave, Anna Dunlap, Joseph Hale, Mrs. Harnly, Marion Maclean, William A. Wolff; 1926: William A. Wolff, Anna Dunlap, Joseph Hale, Mary Ballard, Dorothea Haas, Pauline Holbert, B. M. Duggar, Burridge Jennings, Louise Mast. 1927: William A. Wolff, Joseph B. Hale, Dorothea Haas, Pauline Holbert, Elsa M. Keil, Evelyn H. Mekeel, Constance R. Leavitt, Oscar W. Richards, Betty Spivack, Averill Zimmerman, Louise R. Mast. In this list the person in charge for each year is mentioned first. Those named last are in some cases junior members of the staff, by which is meant younger members who have not as yet entered college.

With the increasing size and multiplicity of activities of the staff a certain amount of differentiation of its duties has become necessary. Accordingly certain members who are best qualified by training attend especially the strictly chemical duties, such as, making up solutions, etc., others may go over the stock and check up the catalogue entries; others may keep especial eye on the stills, used continuously in making distilled water. All of the staff may be thrown occasionally into active service, in rush periods, at the counter, and filling the longer orders which on account of their length connot be distributed until the following day. The duties of the person in charge, as already mentioned, consist in general supervision of the chemical room and making up all orders. The writer feels that in closing an article of this kind mention should be made of certain persons not in the Chemical Room who have nevertheless been of great assistance to it. First and foremost should of course be mentioned Dr. Frank R. Lillie, the third-of-a-century friend of the writer, whose kindly helpfulness, suggestions, and ready acquiescence in various Chemical Room plans has been a constant source of strength to this department The same characteristic seems to distinguish his recent successor as Director. Next should be mentioned Dr. Gilman A. Drew to whose gift for successful and practical planning many of the finest physical details of the Chemical Room are due. Another person whose well-known skill and ingenuity has contributed many important furnishings to the Chemical Room is Mr. Herbert Hilton. However carefully a certain detail or furnishing be planned by the person wanting it, Mr. Hilton can be depended upon to improve that plan. A person the nature whose work perhaps makes it less noticed but not less important is Mr. Arthur H. Bisco who possesses to an exceptional degree patience, attention to detail, an instinct for system and in general a highly intelligent and skillful execution of many plans for the arrangement of supplies in the Chemical Room elaborated by the Chemist in conjunction with him. It we pass to another department we cannot refrain from mentioning the genial and generously obliging Business Manager, Mr. F. M. MacNaught, ably assisted by Miss Polly Crowell, otherwise known as "the Boss". In fact the whole staff of the Business Office should be included. The fact should also be mentioned that many of the investigators and teaching staff of the Laboratory have on innumerable occasions helped the Chemical Room by their suggestions and assistance in other ways. It is perhaps invidious to single out names but perhaps, confining ourselves to the older investigators, there should at least be mentioned Dr. A. P. Matthews, Dr. Walter E. Garrey, and Dr. H. C. Bradley. Finally there should be mentioned that tower of strength, both in his expert knowledge and willingness to help, our confrere Dr. S. E. Pond.

When it is remembered that the Chemical Room supplies and distributes material not only for several classes of quite different character from each other but also for well over two hundred investigators working in very many varied lines of research it is evident that the problems presented are quite unique. There is more analogy to the problems presented by the supplies for a whole university rather than for any single University department. As far as the writer is aware these problems have, in the main, been successfully met. It might also be delicately intimated, when it is remembered that some investigators, especially perhaps those in their earlier careers, do not welcome suggestions, that diplomacy and tact is a very desirable quality in the members of the Chemical Room staff. The M. B. L. obviously cannot provide a series of laboratories each equipped on a scale equal to that seen in each university represented at the laboratory and it is earnestly hoped that any suggestions made by members of the Chemical Room staff will not be received as though reflecting upon the ability or experience of the investigator.

The Collecting Net

A weekly publication devoted to the activities of the Marine Biological Laboratory and of Woods Hole in general.

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(*Application for entry as second-class matter is pending.*)

The Universal Press
New Bedford Woods Hole
Massachusetts

The Scholarship Fund

We have been so busy that we have scarcely had time to give thought to our Scholarship Fund. The lowest amount to be raised was set at $200.00, but, frankly, in naming this modest sum we realize that we are probably over-cautious. Almost one quarter of this amount has already been given, and without the expending of any time or effort on our part.

There are many reasons why one might contribute to a fund such as the one in question. The oustanding reasons are:

(1) The lending of assistance to a deserving, but financially embarrassed student.

(2) The forwarding of biological research and the objects of the Marine Biological Laboratory.

Any expense involved in raising the money will be taken care of by *The Collecting Net*. Thus every cent contributed will be used to help one of our deserving students. Checks should be made payable to "C. N. Scholarship Fund".

Introspection

At this time we are able to give *approximate* figures for the expenses and receipts of *The Collecting Net* for the first three numbers.

Receipts from the sale of copies	$139.00
Receipts from Advertising	333.00
Total receipts	$472.00
Cost of printing and paper	$451.00

This leaves a balance of $21.00 on the desired side of the ledger. Miscellaneous expenses have amounted to $136.00. The larger items in this sum are typing, $15.00; preparing of the Carpenter shop, $17.00, and postage, $69.10. This amount can be divided equally between the eight numbers issued during the season. The sum of $51.00 must then be added to our expenses for the past three weeks. This leaves a deficit of only $30.00.

With these figures we are well satisfied. The average receipts from the sale of copies will not be lowered in August, and those from advertising will be greater. We shall have a sum of money at the end of the year to turn over to the C. N. Scholarship Fund. Of this fact there can now be no doubt.

DIRECTORY ADDENDA

ADDITIONS

Warren, H. C. prof. of psychology. Princeton. Br. 305.

To the Collecting Net:

It was my privilege and pleasure to attend the recent Eighth Annual Meeting of the American Federation of Organizations for the Hard of Hearing. This federation is composed of over thirty-one constituent bodies throughout the country, and its purpose is the prevention of deafness, the conservation of hearing, and the rehabitilation of the deafened. This work is being carried on with cooperation of the U. S. Bureau of Standards, the Am. Med. Asso., and the writer understands, the National Research Council; the constituent bodies cooperating with their local school boards and medical men. Among its officers are Dr. Wendell C. Phillips, N. Y. C.; Dr. Horace Newhart, Univ. of Minn.; Dr. Gordan Berry, Worcester, Mass.; Harvey Fletcher, Ph. D., Western Electric Co., and many other well known men of medicine and science. Among its many activities are: hearing tests for the school, and preschool children, the teaching of lip-reading through the public schools and its own organizations, social activities, scholarships for the deafened, and economic and social surveys.

Julien P. Scott, President
St. Louis League for the Hard of Hearing.

ALGAE

The weather man has been very unkind to the botanists on scheduled field trips this summer, but on Thursday July 21 members of the Botany department and the class in algae spent a very fine day at Gay Head. Quite a few new and interesting specimens were found by the class. Observations were made on the rather strange-colored clay deposits along the coast, and many climbed to the top of the clay cliffs and enjoyed lobster sandwiches from this point of vantage. Pottery made by the Indians living there was admired and bought. These all day trips add spice to the algae course, and we only wish we had time for more of them.

Members of the Botany department and students were hosts at a tea given at the M. B. L. Club on Friday July 22.

ORTHOGENESIS

(*Tune*:—*"The Wearing of the Green"*)

Oh, what is this we hear today about the chromosomes ---
That we must throw them all away and junk our microtomes;
That the pigeons in the dove-cotes tell us how we came to be,
Although the chromosomists rave, and all their coterie.
Thus no meaning should be given to the forms of X and Y,
And Drosophila with all its genes is but a common fly;
For changes metabolic are the cause of that and this,
And the Universe was brought about by OR-THO-GEN-E-SIS.

The epidermic markings placed upon the palm and sole,
Reveal an inner factor that is given the control,
And the hypothenar patterns shown by him and her and me
Are most beautifully graded, showing continuity.
When the facts are plainly written on the little-finger pads.
And the markings of your thenar bear a likeness to your dad's
We must come to a conclusion very similar to this---
That the Universe was brought about by OR-THO-GEN-E-SIS.

Thus in spite of hematoxylin once shed by you and me,
We will gather up our paraffin and pitch it in the sea;
We will analyze a pigeon's egg and print our hands and feet,
And even pawn our miscroscopes to make the work complete.
We will study rows of beetles showing slight degrees of change
We will view them through a spectroscope to get their color-range,
For with the New Biology we arrive at only this---
That the Universe was brought about by OR-THO-GEN-E-SIS.

—*H. H. Wilder.*

SWEET MARIE

It's a question in my mind, sweet Marie,
What in annelids you find, sweet Marie;
Can you number and confirm all the segments of a worm?
Do you know the mesoderm, sweet Marie?

Chorus:—
Sweet Marie—sweet Marie—
Tell me what without the lens you can see;
Do you think you'd better try
With your own unaided eye
To distinguish nuclei, sweet Marie?

Take the carmine from the shelf, sweet Marie;
Think to put it back yourself, sweet Marie;
Take a little frog or fish, put it in a stender dish,
Fix it any way you wish, sweet Marie. *Chorus*:—

Karyokinetic shapes, sweet Marie,
In the anthropoidal apes strange would be;
Take a bit of onion-tip, or a piece or lily-slip,
Or a salamander's lip, sweet Marie.

Chorus:—
Sweet Marie—sweet Marie—
Tell me what without the lens you can see;
You can count the chromosomes
And the archoplasmic zones;
They're more stylish now than bones, sweet Marie.

REWARD!

A free subscription to *The Collecting Net* will be given to the person furnishing information leading to the identification of the individual who lost the creases of his white trousers on the night of July 27. They were left in the Eel Pond!

We learn that a young man—very nicely dressed in white—came down, to the Supply Department Dock whistling as he walked. He climbed into the little white boat that was moored there, and proceeded to carefully bail out the every last drop so that both he and the fair young damsel who was to accompany him could keep their two pairs of handsome shoes from becoming moist. But, alas, this chap was in a mood of carefree carelessness and hummed as he bailed. "And before I knew it" we were told confidentially, "there was a great splash and then just a head a-bobbin' up and down."

Searching inquiries have revealed little more than the fact that when the saddened and bedraggled form shamefacedly crawled out of the Eel Pond he did not present as neat an appearance as before be made his ignominious plunge.

There are obvious reasons for this person to conceal his identity; but there are equally obvious reasons why we must know it. We want to send out our best reporter to interview him. Can not some one help us?

A PARADOX

By heck! but them biologists,
They sure are most queer.
They poke about the pools for scum,
And use the strangest gear.
A dozen different kinds of 'scopes,
Electric ovens, too—
I wonder how they eat the mess
After it's cooked—don't you?

I hern one of them dumbbells talk,
And laffed until I cried:
He says that when germs *multiply*
The goll-darned things *divide*.
Their heads are swelled with calculus
And words that make you sick,
But this poor fish what I hern talk
Don't know arithmetic!

pH. D.

SUNDAY SINGING

The group singing Sunday evening, July 17, which took place on the roof of the Brick Building was a very pleasant affair. The crowd was small, but enthusiastic. More pebbles were scattered over the peanut galery, so that no further catastrophes will occur, since on the previous occasion grave fears were felt that one member of the party would be permanently anchored to the roof. It is said that the Laboratory would be held responsible in cases of tarring and feathering.

Last Sunday a group of over 50 Laboratory workers assembled on the upstairs porch of the M. B. L. Club for the third singing of the season. The incident that caused the most amusement occurred not long after the group assembled. While they were singing, two or three late comers entered themselves to the already loaded porch swing. To the horror of those on it and to the amusement of the rest, the chains suspending the swing suddenly snapped and the group descended to the floor. For the next several minutes there was much more laughing than singing.

Elizabeth Beebe, also a graduate of Oberlin and now an "invertebrate" will be a technical assistant in the department of anatomy at Western Reserve University Medical School.

"Reminiscences of the Fish Commission"

DR. EDWIN LINTON
Honorary Research Fellow in Zoology, University of Pennsylvania

I. Baird at Woods Hole
(Continued)

As the memories of those summers which I spent at Woods Hole in the days of Professor Baird are made to pass in review, I am tempted to speak of those who dominated the foreground; of such personalities as Professor A. E. Verrill, who brought to the scientific work of the Commission a profound knowledge of the invertebrate life of our coast, from Southern New England to Labrador, based on dredging operations, which began in 1860, and continued without interruption to the days I am attempting to recall (It is a pleasure to be able to report here that in a letter, dated January 25, 1923, and written in a firm hand, that, although 84 years of age, he is still working until midnight, or later, every day of the week); of Professor Sidney I. Smith, himself a prodigy of industry in those days, with his keen intellect, and lovable character; of Richard Rathbun, with his habits of close application to the work in hand, which habits never left him, and to whom this magnificent building, in which we are now met, is in no small degree due; of John A. Ryder, a philosopher, whose philosophy rested on the solid ground of nature, into whose secrets he was inquiring—too early taken, to the great loss of science; of Theodore Gill, who awakened a sort of awed wonder in the minds of us younger men by the marvelous range and accuracy of his memory; of G. Browne Goode, whose brilliant mind and honest eye attracted us to him, and upon whom we naturally looked as the one best fitted to continue the work of Professor Baird, when the time should come for him to pass on to other hands the torch which he himself had lighted. Of these and many others I would gladly speak, but I am admonished that my subject is *"Baird at Woods Hole."* But even as the persons whom I have named, and others with them, walk and talk and act on the stage of my memory, there is still the abiding consciousness that there was a moving force, a quiet but persistent directing agency present in it all, and that was the mind of Professor Baird. In a sense, then, we who were there and were endeavoring in our several ways to contribute to the main purpose of all this activity, the laboratories in which we worked, the ships, whose range was in the waters along the coast for many miles, and seaward to blue water, were all but parts of the thought which Professor Baird had projected into the future, and were simply taking places predestined in that thought; much as Alice was one of the things in the Red King's dream, according to the philosophy of her two amiable guides. In this case, however, the projector of the dream of the Fish Commission was not sleeping, and, if he dreamed, he dreamed his dream so well that its realization, which was effected in his day, has suffered no more than temporary perturbation since that day ended.

In 1884 the Residence building was completed and first occupied, by Professor Baird and family, his clerical force, and immediate scientific staff, early in August.

In those days the Commission was extending its work throughout the country, and the executive labor entailed by the various activities of fish hatcheries, distribution of fish, stocking of ponds and streams, was becoming so exacting as to occupy the greater part of the day. So it was that in these, which proved to be the closing years of the Professor's life, his time was more and more occupied with the details of administration; to such a degree, in fact, that one wonders how he succeeded in keeping so well in touch with the scientific side of the work of the Commission as he did.

So far as I recall there was no formal machinery visible in the administration of the work of scientific investigation. The Professor was never too busy, that he could not find time to turn from his desk to advise, counsel, or encourage any one who was engaged in scientific research who desired an interview with him. His wisdom led him to leave the initiative with the investigator himself, although, now and then, he might suggest lines of research, which, to his mind, seemed to call for investigation. He held to the belief that it was not best for the beginner in zoology to become too early absorbed in a narrow problem; rather, he thought that the best foundation was laid by the beginner's making himself an authority on some natural group of animals. While holding to this view, he was not in any sense dogmatic, and ever kept an open mind, singularly free from prejudice. Amid all the distractions of administrative duties the atmosphere which surrounded him was charged with the stimulating energy of scientific inquiry.

Reminiscences of the Fish Commission

(Continued from Page 8)

As I recall the life at Woods Hole in the summers of 1882-1887, about the only recreation which Professor Baird seemed to allow himself was that which was derived from the relaxation which he found in keeping himself acquainted with world affairs, and with current literature, not even wholly neglecting the more evanescent contributions. His familiarity with current literature and world events, outside his immediate and multifarious scientific interests, was largely due to the ministry of his wife, a woman of remarkable intelligence and humor, and of his talented and devoted daughter. The easy and natural conversation at table, and in the evenings, after the wearying, and no doubt often trying hours at his desk, which these adoring companions contributed to his daily life, not only supplied needed recreation, but kept him in touch with the world's best thought.

As the increasing burdens of administrative work, which he never learned to shift to other shoulders, and which he brought with him into what should have been a vacation, began to tell on him, one can understand the relief he must have found in following the adventures of Little Lord Fauntelroy, and his anxiety for fear that some disaster might befall the author, before the story, which was running in St. Nicholas, would be finished, and his relief, when he found upon inquiry that the manuscript of the complete story was in the hands of the publishers.

In the early days of the Fish Commission scientific investigation was even less understood than it is today, and it was Professor Baird's wish that visitors to the laboratory should be instructed in the importance of gaining a knowledge of all conditions which in any way affect fishes. Although he did not say it, I am inclined to suspect that the thought was somewhere back in his mind that we might now and then be entertaining congressmen unawares. Indeed it was no unusual thing for people of influence in public affairs to visit the laboratory. Visitors to the laboratory were many, and of great variety of intelligence, if one were to grade them on the nature of the questions which were asked. Questions as to what it was all about, and why, were perennial. These proved to be so difficult to answer in a way that satisfied visitors of the sanity of the investigators, that, according to Dr. Andrews, it was Professor Verrill, who, finding that his attempts to enlighten his interlocutors, on one occasion were unavailing, had an inspiration, and told his visitors that he was paid for it. This was held to be a quite satisfactory answer. If the curious visitors had been given the exact amounts of the pecuniary rewards of those whom they saw engaged in what they heard was called scientific research, it may be that they would still have had lingering suspicions of the lunacy of such people.

Sometimes the interest of visitors made itself felt in rather surprising ways. According to Dr. Andrews, it was at Newport that Professor Sidney I. Smith complained that certain fair visitors, who were watching him at work with his microscope, breathed down the back of his neck. And I myself was witness to a similar incident in the laboratory on Little Harbor, and heard J. H. Emerton, a gentle bachelor, who loved spiders, but was shy of women, wail a similar protest, as a lively party of chattering visitors were going down the stairs. I think that the Professor listened to accounts of such happenings with almost as much interest as he did to reports of the finding of new species.

Visitors of celebrity, who came to pay their respects to Professor Baird, were not infrequent. I remember, on one occasion, the President of the United States was there over night, was given an exhibition trip on the Fish Hawk, and the process of operating the beam trawl was shown him. Now we younger assistants, coming as we did from inland, knew nothing at first hand about Presidents and their ways, or of the ways of those who were accustomed to be about them. When we were told that there was to be a collecting trip in the morning we reported for duty in our usual unconventional attire. By the time the Fish Hawk was steaming out into Vineyard Sound we made the discovery that, officers and crew, and everybody else on board, were, each and all dressed in honor of the Chief Executive, all bravely clad, and easy in their minds, except three young men, who were having all the disagreeable sensations peculiar to those who dream of like unpleasant experiences. I remember yet, quite vividly, the appraising look which the Professor gave us just before, as it seemed to us, he decided not to present us to President Arthur.

A visit made to the laboratory by the wife of President Cleveland, devoid as it was of ceremony, made a pleasant impression on us, and left a memory of unaffected and intelligent interest, on the part of the visitor, in what was going on.

There were other visitors, giants in their day, who did not owe their distinction to political success; such as Professor E. D. Cope, S. Weir Mitchell, and Dr. William Osler, all warm friends of Professor Baird. It is a pleasure to recall that these men took the time to sit down by the tables of us young men, and showed by their intelligent questions, and understanding comments, that their interest in our attempts to find out about things was genuine.

Those of us who returned to Woods Hole in the summer of 1887, were shocked to see that in the months which had intervened since we had last seen the Professor, the Great Destroyer had been busy, and had almost completed his work. Through July and the first half of August we were saddened by the daily sight of the once vigorous frame, now pitifully wasted, as he was wheeled about in an invalid's chair by the faithful George Butler.

In spite of his enfeebled condition he was still interested in what was going on. I remember that following a short conversation with him in July, he advised that Vinal Edwards and I should go to Nantucket for certain material.

Near the end he had George take him about the grounds which surround the Residence building, for a last look, and through the various rooms of the laboratory, where he had a kindly, and not uncheerful word for every one.

Then, on the 19th day of August, 1887, at 3:45 P. M., in the Residence building of the U. S. Fish Commission, he died.

To the prescribed church service, which was read by the rector of the village church, were added the beatitudes which pronounce blessings on the peacemakers, and on those who are pure in heart.

NOTES AND NEWS

The Gilchrist Potter prize, an Oberlin award was made to Madeline Field, who is at present engaged in research work at the Laboratory. Miss Field will teach at Simmons College for the first semester of the coming year, and will follow it with graduate work at Harvard Medical school during the second semester.

Miss Madeline Field will be teaching at Simmons College for the first semester of this year and will then take up graduate work at the Harvard University Medical School. Miss Field was the recipient of the Gilchrist Potter prize at Oberlin this year.

"What Limits Size"

(Continued from Page 2)

The speaker next outlined his bio-equation by means of which there is obtained a mathematical expression of an organism or part of an organism, an equation after which, as he said, you can write "Q. E. D." in the same sense that it is written after a demonstration in geometry.

As a great deal of mathematics as is used in genetics was merely alluded to, inasmuch as this particular matter is often discussed nowadays, and it was, therefore, assumed to be familiar to all.

Next a passage from the speaker's address given as the annual address before the Australasian Association for the Advancement of Science, 1892, was repeated in order to picture graphically the range of frequencies from O to infinity, and this was followed by a discussion of the manner in which the mathematics of frequencies is "invading" biology, the experiments of Schneider and Sperti and their colleagues being cited as suggesting that the coincidence of certain electronic frequencies in the molecules of living matter with those of external agents are not only of great consequence, but capable of mathematical expression. As the molecule has become amenable to mathematics, the degree of mathematical exactness that bids fair in time to dominate biology will be of that degree of exactness characteristic of astronomy, since the ratios of the numerical values in organic molecules are of somewhat the same order as those in astronomy.

As a particular instance, a brief allusion was made to the speaker's polariscopic investigations of the very small birefringents existing in living cells. These bodies vary in size from a very few microns down to and beyond the limits of resolution. Undoubtedly in this region of biological research volumes, essentially mathematical, will be written that will read like the pages of crystallography, dominated by the mathematics of the light-frequencies used to explore what we now call protoplasm.

The speaker alluded to the gibe of an engineer that "biologists know about enough mathematics to make change and that is all", and himself suggested, using astronomy as a "measuring stick", that mathematically speaking, biologists are perhaps now about where the Chaldeans were when they made their survey of the Heavens.

Finally, the speaker described briefly the nature of the polariscopic apparatus he is using and hopes to devise for the study of the excessively minute birefringents existing in living cells, and concluded with an earnest appeal for the devotion of a very large sum of money to the improvement of the microscope, stating his belief that no money devoted to any conceivable hospital or other similar philanthropic institution could possibly approach the service that might be rendered mankind by improvement of the microscope, the instrument that has probably contributed vastly more to the advancement of mankind than any other invention of modern times. A long study of the possibilities convinced him that the microscope is still capable of great improvement and that such improvement will make possible the investigation of problems involving what appear to be the critical relationships between light and life, a region of research at present beyond reach mainly because of the limitations of the microscope. The use of the frequencies necessary for these investigations is, at present, probably almost within reach. The possibility of "stepping down" the higher (super spectrum) frequencies was alluded to as well as the use of lower harmonic frequencies.

To seek development in this direction, i. e. improvement of the microscope, is shown to be one of the most logical of efforts by the fact that success would amount to a further extension of human eyesight, the most valuable to us of all our physical assets.

The Story of Woods Hole

(Continued from Page 3)

one. One only came from New England.

The investigators came from

The Institute of Technology	2.
Bryn Mawr	1.
Mount Holyoke	1.
Wellesley	1.
Vassar	1.
University of Michigan	1.

Professor Sedgwick and his wife were staying at the hotel at Quisset Harbor and during the summer Professor Sedgwick came into the laboratory almost every day. He was a trustee and had been most influential in starting the Laboratory. I remember that he gave us a talk on the Sundew, a plant which he discovered grew plentifully in the region.

The address at the opening of the Laboratory was given July 17, 1888, by Dr. Whitman the Director. It may be found in the Report to the Trustees for 1888. Those present were: Mr. Van Vleck, a Penikesian, C. M. Clapp, a Penikesian, Dr. Minot, Prof. Sedgwick, Dr. Gardiner, Miss Cushing, Miss O'Grady, E. O. Jordan, Miss Harris, Miss Mulford, Mr. Washburn, Mr. Fay and a few other persons from the town.

As soon as I was located and the Laboratory was opened I had to decide what work I should begin. The question was—should I enter as a student or as an investigator. I think the views of Dr. Whitman in regard to the way to study really settled the matter and I became an investigator.

The next question was, What subject should I investigate. The recently published work of Allis on Amia, done at the Allis' Laboratory, lead Whitman to consider further study of that subject desirable. So he recommended that I take for my subject of investigation The Lateral Line System of the Toadfish (Batrachus tau.) This I did with the consent of Dr. Ryder, who had worked on this subject. This was the first subject given out at The Marine Biological Laboratory and Allis' first publication on Amia was shown to me as a model for my own work on Batrachus tau. The Journal of Morphology was a new thing in the United States at that time for the publication of original work.

I can see Dr. Whitman sitting down with us, showing us how to draw, telling us about the technique, making us feel that time was no consideration; our business was only to *see* and to *get the results*. The thoroughly scientific spirit which was evident and the complete absence of sensationalism was shown when he honestly told us that we should not waste our time with *lectures*. I was introduced to his ideas of original work or research, to his methods of work, to the idea, that persistent and completely absorbed attention to one subject will lead to comprehension of much beside that. This was a new idea to me. Serial section cutting was new. It opened up a new aspect of work along biological lines.

The atmosphere of that laboratory was an inspiration; the days were peaceful and quiet; there were no lectures nor anything else to distract the attention from the work in hand.

History Of Woods Hole Is Theme Used By Artist

(Continued from Page 1)

and the wharf was made of thirty foot poles corn-cobbed together in a square, dowelled in and filled with stones.

The next canvas memory of Woods Hole was around 1840 on the site of the Penzance garage. A magnificent 400 ton whaling vessel was built there on the pier directly over the water and when the ship was ready for sailing the owner ingeniously removed part of the wharf and let the boat slide into the water like a skiff. This event which Mr. Gifford has painted occurred about ten years before he was born.

In the pre-railroad days of Woods Hole of 1845 Little Harbor boasted a heathy stagecoach traffic. Travellers would put up at Joe Parker's prim looking tavern with its second story porch and a watch tower on the roof. Five of the houses that stood on the road to the tavern are still there; Mrs. Purdam's home, Miss Josephine Fish's, Miss Sarah B. Fay's, and Miss Fanny Robinson's home. The old Bradley house was later moved to a site near the laboratory.

In the relatively modern times of Mr. Gifford's youth Woods Hole was a busy little town, its shores dotted with houses; its back yards (where there were back yards) became undulating corn fields shaped in with stone fences. There was a grist mill, a candle factory, a guano works, a cooper's shop, a fish drying industry and a whaling fleet. But Mr. Gifford, pondering these things, remarked, "There wasn't anything doing here before the 'Biological' came. I'm glad it's here!"

OUR BACIA

The lectures in the Physiology course are being carried on by Professor Michaelis who continues the work in physical chemistry on Tuesdays, Wednesdays and Fridays. Dr. Fenn is lecturing on the other three days on "varied response", particularly of muscle and nerve, to changes in oxygen and other external factors.

On July 21 Dr. Redfield gave a special lecture in which hemocyanins were ably discussed. These copper-containing pigments are under investigation, as they offer a more readily controlled group than the haemoglobins.

CILIA AND CILIA

Having left our first despond plateau, we were stimulated by an interesting lecture on Free-Living Amoeba by Professor Schaeffer of the University of Kansas. As a Proteus guiding his sea calves, Professor Schaeffer has kept an eagle eye on his flock of amoebae. His observations and resulting conclusions have caused almost as much discomfort as the judge who awarded the golden apple at that ancient beauty contest. In other words, *Amoeba proteus* is not what it was formerly conceived to be. Seven forms have been singled out of which one is classified as *Amoeba proteus*. Thus amoebae are being more specifically classified so that when *Amoeba proteus* is mentioned, a definite concept can be formed and discussed.

On the other hand many observers think that amoebae will not be able to be classified due to the varied vicissitudes of their life histories. Still Professor Schaeffer has confirmed his species to a certain degree by complement fixation tests after the manner of Nuttall.

It is of interest to report that James Harvey Robinson, author of "The Mind in the Making" can be seen plugging away at his desk in the laboratory.

The class taxonomist has been busy trying to classify seventeen or eighteen forms that have come to his notice. It has been a difficult task, but following Professor Schaeffer's example, he makes a good try.

The most outstanding organism first to be classified was a member of the Ciliata difficult to place because of its numerous anterior cilia and enormous peristomio cirri, to say nothing of its rigid body. A study of its life history has revealed that it sporulates frequently. These ciliated spores are usually found on the tennis court. One observer on an off day observed these spores in a degenerate cycle associated with the horseshoes west of the wooden laboratory. In some forms endomixis has been observed; ectomixis cannot be hoped for. Most observers however hold that this form is free living. It so resembles Dysteria of the Holotrichida that it has been named Hysteria hetheringtonensis.

Still another variety of Ciliata has been described as anteriorly, peripherally ciliated and is usually found in the finger bowls of the laboratory, more often, however, on the beaches. The "tyro" who is anxious to collect may be the first to detect Strombonium morrisiana by a specialized bark which resembles the mammalian cough. The taxonimist has neglected to mention that hysteria hetheringtonensis can be detected by queer sounds that resemble the English words "Marvelous! Marvelous! Simply ripping!" The taxonimist must not be taken too seriously as the writer believes that Ehrenberg's spirit still prevails.

Another peripherally ciliated form might be described as having a round head, had Ehrenberg been reading a history of Cromwell the night before he made these observations. Just now it is rarely ever found in the laboratory, being now classified among the "Four Hundred". Its life cycle can be studied best at night. Beware of Lacrymaria dolor to be changed to Lacrymaria laetitia after August first.

Water Sports

(Continued from Page 1)

sults of each event will be announced promptly from the float. Contestants will be summoned by the announcer to the float a few minutes in advance of the event in which they are entered, thus avoiding all possible delays.

Posters announcing the Water Sports will be displayed in conspicuous places well in advance and will advise the contestants to hand in their names, together with the event or events which they plan to enter, to a designated official.

Following are the events which have been scheduled, in the approximate order of their occurrence on the program:

Boys' Race: 12 years and under (25 yards)
Girls' Race: 12 years and under (25 yards)
Boys' Tub Race: 12 years and under
Girls' Tub Race: 12 years and under
Junior Boys' Dive: 16 and under
Junior Girls' Dive: 16 and under
Boys' Race: 15 and under (50 yards)
Girls' Race: 15 and under (50 yards)
Senior Boys' Dive: over 16 years
Senior Girls' Dive: over 16 years
Boys' Race (Dash and Long Distance): over 16
Girls' Race (Dash and Long Distance): over 16
Relay Races
Cone Tilts

Helen Te Winkol (Oberlin '26(has been appointed laboratory assistant in physiology at Mt. Holyoke for the next college year.

EMBRYOS

Under Dr. Graves' guidance we began the fourth week by pursuing the squid from the cradle to the grave. Being an extremely obvious thing the micropyle was seen easily and the variegated chromatophores made our drawings look all the more like the comic strip in the Sunday paper.

Nereis and Crepidula with Dr. Packard as sponsor made their debut in the embryology lab. on Thursday. They are complete social successes, in fact everyone has gone dizzy over Crepidula.

Dr. Rogers' grand finale was made when on his last day in lab. he was explaining something in Dr. Conklin's lecture and ended by saying "It certainly seems to work according to Hoyle". One puzzled student gave an agonized look and said, "But it was *Conklin* who discovered it, wasn't it?"

Dr. Baker's lecture on "Tissue Culture" with its slides and movies was the first thing that has chased away that tired look from the hard working students. These attempts to prove Thomas A. Edison's theory that man does not need sleep, have met the same result as many other research problems — complete failure. Miss Baker of the Rockefeller Foundation has done an interesting piece of work on tissue culture, studying especially the nutrition of the growing cells.

After numerous visits to the dark room Gonionemus has finally been prevailed upon to lay eggs. The race for the lobster dinner which Dr. Plough has promised to the one who succeds in raising a larval form with more than three arms, has begun.

Dr. Just's lecture on "Fertilization" is scheduled for this coming week and there is a possibility that we may soon hear Dr. Galtsoff tell about oyster spawning.

Corporation Meeting

The annual meeting of the Corporation of the Marine Biological Laboratory will be held in the auditorium of the laboratory at Woods Hole, Mass., on Tuesday, August 9th, at 12 o'clock noon for the election of officers and trustees and the transaction of such business as may come before the meeting.

Coast Guard Day will be observed on August 4, and elaborate plans have been made for its celebration at Base 18, including a special banquet at which Congressman Charles L. Gifford will be a speaker.

Currents in the Hole

At following hours the current in the hole turns to run from Buzzards Bay to Vineyard Sound:

	A. M.	P. M.
July 30	6:13	6:29
July 31	6:57	7:11
Aug. 1	7:41	7:59
Aug. 2	8:26	8:47
Aug. 3	9:10	9:31
Aug. 4	9:59	10:20
Aug. 5	10:33	11:06
Aug. 6	11:27	11:56

In each case the current changes six hours later and runs from the Sound to the Bay.

DAWSON HEADS HORSESHOE TOSSERS

Annual Ladder Tournament In Full Swing As Season Wanes

Dr. J. A. ("Art") Dawson was the proverbial "popular champion" during the week of July 18th, successfully defending his title as No. 1 man in the Annual Horseshoes Ladder Tournament against no less than four challengers. In only one of these matches did Dawson lose a game, namely, in his tiff with Frank Swett, who took the first game 21-13. All his other victories were clear-cut and decisive.

The ranking of the contestants at present is as follows:

1. J. A. Dawson
2. O. L. Inman
3. F. H. Swett
4. E. A. Martin
5. J. W. Wilson
6. A. H. Sturtevant
7. D. E. Lancefield
8. L. Hoadley

The principal change in this order during the past week was brought about by Swett, who moved up to No. 3 position by his win over Earl Martin. Inman prevented Swett's further advance by beating him in straight games, 21-17, 21-17, thus retaining his own post at No. 2.

Following are the outstanding championship matches for the week of July 18th:

July 18—Dawson d. Swett: 13-21, 21-7, 21-10.

July 20—Dawson d. Martin: 21-10, 21-12.

July 21—Inman d. Swett: 21-17, 21-17.

July 22—Dawson d. Lancefield: 21-6, 21-0; Dawson d. Hoadley: 21-14, 21-13, Swett d. Martin: 21-19, 21-5.

Elizabeth H. Parsons, a graduate of Oberlin and now a member of the embryology class here, has been appointed graduate assistant in zoology at Wellesley.

THE COLLECTING NET

Volume II
Number 5

WOODS HOLE, MASS., SATURDAY, AUGUST 6, 1927

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CLUB PLAYS ARE GIVEN SATURDAY

For several years the M. B. L. Social and Tennis Clubs have combined to give an annual entertainment consisting of one-act plays, music and variety numbers. This year a gala performance has been arranged for Saturday evening, Aug. 6, at 8:30, in the M. B. L. Auditorium.

In order to meet the varied tastes of the members of our large and complex community—to please the high-brow, the low-brow, and the omni-brow, and to do it in one evening—a diversified feast will be laid before them, and it is predicted that he will be a most ardent pessimist and misanthrope who will not thoroughly enjoy some part if not all of the program. There will be two one-act plays, instrumental music of a high order, and several vaudeville numbers accompanied by, and interspersed with, appropriate music.

The first play will be a dramatization of a scene from Booth Tarkington's famous book "Penrod and Sam", entitled: "Concerning Trousers". All the work on this play—the adaptation, directing, scenery, and (with one exception) the acting—is being done by an enthusiastic junior dramatic group the oldest of whom is thirteen years old.

(Continued on Page 11)

M. B. L. Calendar

Saturday, Aug. 6
8:30 P. M.

M. B. L. Club Plays. Auditorium. Admission: 50 cents and $1.00.

Sunday, Aug. 7
9:00 P. M.

Informal Singing. Upstairs on the M. B. L. Club porch.

Monday, August 8
12:00 M

End of Class Work.

Monday, August 8

Concert: Woods Hole Choral Society. M. B. L. Auditorium.

Tuesday, August 9
12:00 M.

Annual Meeting of the Corporation of the Marine Biological Laboratory.

Friday, August 12
4:00-6:00 P. M.

Tea. Investigator. M. B. L. Club.

REMINISCENCES OF THE FISH COMMISSSION

Dr. Edwin Linton

Honorary Research Fellow in Zoology, University of Pennsylvania

II. Early Days

Some years ago, in an evening lecture before the Marine Biological Laboratory, I gave some reminiscences of the Woods Hole Laboratory of the Bureau of Fisheries. This lecture was published in *Science* vol. 41; pp. 737-753. Also in *Science*, vol. 48; pp. 25-34, there is published *An Appreciation of Spencer Fullerton Baird*, in which reference to his work at Woods Hole is made. In the two issues of *The Collecting Net* which precede this issue there appears a paper which was prepared for a special occasion, the title of which paper is: *Baird at Woods Hole.*

In complying with the editor's request that I write some of my recollections of the Fish Commission at Woods Hole for *The Collecting Net*, it is not my intention to make much use of material already published, although, naturally, as I attempt to recall memories of times past, the same persons, and doubtless some of the incidents which came to the front in my published reminiscences will again appear on the stage.

It was in the summer of 1882 that I had my first experience with the U. S. Fish Commission. I had just finished a year's graduate study at Yale where most of my work had been with Professors A. E. Verrill and Sydney I. Smith, both of whom

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Corporation Meeting

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THE GENE AND THE ONTOGENETIC PROCESS

Frank R. Lillie

Professor of Zoology, University of Chicago

Dr. Lillie delivered a lecture bearing the above title on the evening of July 22. The author's summary and a review of the paper follow.

The presentation involved two aspects: first, critical, to offset the conception especially as presented by Goldsmidt in his "Physiologische Theorie der Vererbung", but also outlined by others, that the theory of the gene may be developed into a complete theory of the organism. Second, constructive, to seek by correct definitions the respective roles of the physiology of development and genetics in the life history. It was pointed out in the introduction that the conception of a single theory covering both genetics and the physiology of development is a reversion to the unitary conceptions of Darwin and Weismann, and it was maintained that work since their time has led, and is still leading, to a sharp separation of these two disciplines.

Since as a result of modern investigations genetics has become quite a unitary science, while physiology of development is at most a field of work, it was considered advisable to proceed by an examination of the necessary concepts of phsyiology of development, followed by an inquiry into the relation of the theory of the gene for each concept.

The concepts considered were those of the germ, of individuation, and of differentiation in its two aspects of embryonic segregation of potencies and of realization of potencies.

Omitting in this abstract the definitions of the germ and of individuation, embryonic segregation was characterized as follows:

1. Its action proceeds from the more general to the more special in a definite sequence which is both dichotomous and discontinuous.
2. This results in a progressive genetic restriction, of a more or less fixed kind, in the primordia thus established.
3. These processes exhibit definite order, (a) in time, (b) in space, i. e. localization in the

(Continued on Page 4)

Review

by Leigh Hoadley

Assistant Professor of Zoology, Harvard University

Those who heard the lecture of Prof. Frank R. Lillie a week ago Friday evening had probably anticipated a comprehensive discussion of this subject by one who has been in intimate contact with much of the important work on the physiology of development, and one who has made definite contributions of a very high character to its fundamental concepts and hypotheses. Nor were they disappointed.

After mentioning the divergence of schools which followed the overthrow of the deterministic hypothesis of Weismann, Prof. Lillie emphasized the differences which exist today between the schools dealing primarily with nuclear or cytoplasmic phenomena, and then showed the importance of recognizing both aspects to any adequate theory of development. This was nicely expressed in the discussion of the fundamental concepts which were presented as an introduction to the development of the main theses. These, *viz.*, the germ, individuation and differentiation i. e. the origin of embryonic segregates together with the elaboration and realization of potencies of the final term, lead to several conclusions which are extremely important to an adequate conception of developmental processes.

I do not wish, nor is it my place, to review the definitions which were given, but there are certain qualifications which I wish to emphasize. In the first

(Continued on Page 5)

THE BEHAVIOR OF GORILLA BERINGEI

EVENING LECTURE

ROBERT M. YERKES
Professor of Psychology, Yale University

REVIEWED BY HOWARD C. WARREN
Professor of Psychology, Princeton University

Professor Yerkes is well known among psychologists as one of the foremost investigators of animal behavior. He has made many first-hand studies of various species and is author of a monograph on the Dancing Mouse. In beginning his lecture Dr. Yerkes warned the audience that, though interested in the study of behavior, he is not to be classed as a *behaviorist*. The latter term is applied to a philosophical theory, which limits scientific investigation in the field of psychology to the examination of actions and conduct, ruling out altogether the study of conscious phenomena. Dr. Yerkes is not in sympathy with this doctrine. He claims the privilege of studying animal consciousness, and of using mental terms freely in describing the behavior of subhuman species.

The lecture was a report, illustrated by motion pictures, of the behavior of a young gorilla observed under careful control conditions by Dr. Yerkes, in January, 1926, and again a year later, in January, 1927. Apparently the first historic reference to the gorilla was by Hanno, a writer of the fifth century B. C. There are uncertain references by Battell (1625) and Monboddo (1774), and a recognizable description by Bowdich in 1819. The first scientific description was published by Savage and Wyman in 1847. Even today little is known about the live gorilla, and our knowledge of the genus is confined to the more common species, Gorilla gorilla. The other species, G. Beringei, is comparatively rare and occupies a very limited habitat in Central East Africa. The subject of Dr. Yerkes' investigation was a female named Congo, practically the first specimen of the species to be kept alive in captivity for any considerable time.

In general, Congo's behavior was characterized by slowness of movement, and lack of sustained interest. Most striking was her inability to grasp total situations or to generalize a situation. For example, after learning to use a drinking cup, she was unable to transfer the common elements of the situation to the use of a milk bottle, and for a long time managed to spill most of the contents. After learning to place one box on another so as to reach suspended food, it required a long period of trial and error before she advanced to the three-box stage. One of the most illuminating "passages" in the lecturer's films shows Congo seated on a two-box elevation, holding a third-box in her lap, and gazing alternatively at this box and the suspended food. There were attempts to lift the box toward the food, to hold the box in mid-air and at the same time to mount upon it; she failed entirely to generalize the act of "putting box on box". And again, after learning to untwist a long chain wound in and out of a many-trunked tree to which Congo was usually tethered, she was unable to perform the same operation when removed to any other tree.

Curiosity was a prominent trait. The mirror brought this characteristic especially to the fore. The films showed Congo gazing steadfastly at her own reflexion for long periods, tapping the mirror or pressing her face against it, occasionally peering behind or dashing back toward the supposed companion. Only in this particular problem and in problems connected with food-getting did she manifest sustained interest. Accordingly, most of the investigations reported were connected up with the subject's securing her food supply.

There was little evidence of mechanical ability. Food was placed in a box, the lid closed and secured with hook, padlock or other simple device. Even the simple act of removing a curved hook from the hasp was reached only after a long period of fumbling. In this and other respects the gorilla showed marked contrast with chimpanzees previously tested.

Several experiments were devised involving the use of tools. Placed in a cage, with food just beyond her reach outside, Congo was able after a time to use a stick to "coax" the food within reach. It required much longer to learn to use a short stick to get a longer stick with which the food could be reached. Another experiment involved running a long pole through a pipe in the center of which the food had been placed, and pushing the food out at the far end. The films show instances of the gorilla pushing the pole along *outside* the pipe, while she peered steadily *through* the pipe to observe the effect. After these futile efforts, she rolled over on her back in an attitude indicating utter fatigue, despair, or meditation.

This and other attitudes suggest to the reviewer that the gorilla possesses a capacity for deliberating on the elements of a problem (of a food-problem, at least), without the capacity for mentally combining these elements—both factors being essential to the solution, except by a long trial and error process. The absence of this combining capacity in the problem appears to be somehow connected with her lack of ability to imitate—an ability which is possessed in a marked degree by chimpanzees and other primates. The performance of the necessary action by the experimenter never helped Congo in any observable way toward the solution of a problem. This lack of imitativeness Dr. Yerkes attributes to the gorilla's inability to focus her attention on the mechanism of extraneous activities—in every case she was watching the food, not the experimenter's procedure.

On the other hand, the subject showed a remarkably long memory, or delayed reaction, as compared with other animal species. She could find buried food after a period of three hours, whereas for mammals below the primates the experiment fails for intervals longer than a few minutes. This, again, supports our suggestion of a deliberative ability, or at least some mental process of similar nature.

The lecturer dwelt on the apparent general mental inferiority of the gorilla to the chimpanzees on which he has made long and careful investigations. One might raise the question in this connection, how far this particular specimen, Congo, is typical of her species. It may be that we are dealing with a subnormal individual. It is unfortunate that Dr. Yerkes was not able to check up her behavior with at least one other specimen of the same species. However, in the absence of any marks of disorganization in behavior, one is prabably justified in assuming that the subject observed represents, in a general way, the mental level of Gorilla Beringei. The experiments were carefully planned and may be accepted as giving a true picture of the subject's mentality.

Dr. Yerkes' lecture demonstrated conclusively the value of the moving picture as a means for studying animal behavior. A passing phase may be caught and reobserved as often as is necessary for complete analysis. The investigator is thus able to examine incidental conditions and circumstances connected with an act. It is useful also for demonstration. An audience will reach an understanding of the various modes of activity, and appreciate the limiting conditions far better, by this pictorial method of presentation than by listening to mere verbal explanation. There was abundant evidence of this in the present instance, in the reception of the pictures following Dr. Yerkes' lucid description of his experiments.

TIDAL CURRENTS

In navigating coasts where the tidal range is considerable, special precautions are necessary. It should be remembered that there are indrafts into all bays and bights, although the general set of the current is parallel to the shore. The following pointers are gleaned from *The United States Coast Guard Pilot* (*Section B.*)

(1) The turn of the tidal current off shore is seldom coincident with the time of high and low water on the shore.

(2) At the entrance to most harbors without important tributaries of branches the current turns at or soon after the times of high and low water within. The diurnal inequality in the velocity of current will be proportionately but half as great as in the height of the tides. Hence, though the heights of the tide may be such as to cause the surface of the water to vary but little in level for 10 or 12 hours, and flow will be much more regular in occurrence.

(3) A swift current often occurs in narrow openings between two bodies of water, because the water at a given instant may be at different levels.

(4) Along most shores not seriously affected by bays, tidal rivers, etc. the current usually turns soon after high and low tides.

(5) Where there is a large tidal basin with a narrow entrance the strength of the current in the entrance may occur near the time of high or low water, and slack water at about half tide, outside.

(6) The swiftest current in straight portions of tidal rivers is usually in the mid-channel, but in curved portions the strongest current is toward the outer edge of the curve.

(7) Countercurrents and eddies may occur near the shores of straits, especially in bights and near points.

(8) Tide rips and swirls occur in places where string currents occur, caused by a change in the direction of the current, and especially over shoals or in places where the bottom is uneven. Such places should be avoided if they are at the same time exposed to a heavy sea, especially with the wind opposing the current. When these conditions are at their worst the water is broken into heavy choppy seas from all directions, which board the vessel, and also make it difficult to keep control, owing to the baring of the propeller and rudder.

Dr. W. Mansfield Clark, at present Professor of Chemistry at the Hygienic Laboratory of the U. S. Public Health Service, Washington, D. C. has accepted the position of Professor of Physiological Chemistry at the School of Medicine of The Johns Hopkins Hospital.

The great horror is not in discovering what man descends from but in what he descends to.

LUMINOUS BACTERIA AND PHOTOSYNTHESIS

E. Newton Harvey
Professor of Physiology, Princeton University

Dr. Harvey delivered a lecture on July 13 before the Botany Seminar bearing the above title. A summary of the lecture and a review follow.

Summary

by Charles S. Shoup
Princeton University

Most sea animals develop, a few hours after death, small colonies of luminous bacteria on the surface of their bodies. This occurs before putrefactive bacteria have begun activity and have overwhelmed these other very interesting forms. Such peculiar growths were known to Boyle many years ago, for he found them growing on meat at ordinary temperatures. Now we are able to isolate these organisms and transplant them into artificial media containing a considerable quantity of salt and adjusted to a decided alkalinity. The medium prepared for this purpose is usually a peptone-glycerin-agar in sea-water. In a few hours an abundant growth appears in good media and the organisms may be handled and transplanted in routine bacteriological technique.

Luminous bacteria are quite harmless, and they may be found within the bodies of some small forms, such as the sand-fleas with which we are familiar here at Woods Hole. Only the salt-water forms are luminous, but these bacteria may infect fresh-water animals. Certain luminous shrimps in Japan and a squid found at Naples, are luminous due to growth within the body of these organisms. Animals have been injected with luminous bacteria and have been made to glow for a time, but such forms cannot grow in living mammals, for there the temperature is too high. Some animals have a symbiotic relation with bacteria, as Photoplepharon, the fish with a modified organ for the continuous growth of luminous bacteria peculiar to the fish itself.

Luminous bacteria are not affected by stimulation, except as they become more luminous when oxygen is added to the medium after partial absence of air. Their glow is steady and similar to the glow of luminous fungi, rather than to the intermittent glow of the firefly or of other luminous forms with which we are familiar. Luminous bacteria are not visible in the sea-water, for there they are dispersed so widely that there are no aggregations of the millions necessary to give easily visible light. Luminous bacteria may be subjected to the action of anesthetics and recover. A small amount of KCN will dim the light and slow the oxidation processes. The luminescence, however, may only be reduced to one-quarter while the respiratory oxidations are reduced one twentieth.

Boyle found that when a tube containing a suspension of these luminous organisms was allowed to stand, it shortly became dimmed and the glow disappeared, only to reappear upon vigorous shaking with air. The glow of the bacteria is absolutely dependent upon abundance of oxygen, and it is for this reason that they constitute splendid indicators for detecting the presence of oxygen in liquids and at the phase-boundary between liquids and gases. It has been shown that a suspension of luminous bacteria begins to dim when about 2% oxygen is present. The flow-meter has been used for measuring the amount of oxygen just necessary to produce light. This has been found to be .0053 mm. Hg. oxygen tension. Consequently the presence of luminous bacteria may be utilized as a very delicate test for oxygen.

Beijerinck in 1902, was the first to study photosynthesis, with luminous bacteria as an indicator of the process. Using an emulsion of ground clover leaves, he found that photosynthesis continued when the clover cells were destroyed, and that photosynthesis continued in red light and not in blue when the electric arc spectrum was projected by a prism on the plant, Ulva. Molish, in his studies of dried leaves, found that a filtrate of Laminum leaves dried four days in air and two days in a dessicator could produce oxygen. This seemed to be an exception, but in 1925 he found that the leaves of many land plants will photosynthesize after drying rapidly.

Dried leaves ground in a mortar with water, the unfiltered mass being added to a suspension of luminous bacteria, will cause a dimunition in the glow of the suspension in from five to ten minutes. Upon illumination the bacterial glow again appears, due to photosynthetic oxygen from the suspended chloroplasts. It has been found that dried clover leaves will photosynthesize even after three months in this condition. Frozen leaves will photosynthesize again when warmed and immediately tested, but they soon lose this power.

Luminous bacteria, due to their ability to absorb oxygen as well as to glow in minute quantities of oxygen, are then especially adapted as indicators to study photosynthesis after plants have been under anerobic conditions for some time. Most marine algae can photosynthesize immediately on illumination, even when kept in an oxygen-free emulsion of luminous bacteria for one half hour.

Review

by Conway Zirkle
Bussey Institution

It is not often that the Botanists can have at one and the same seminar a show, an account of progress in the investigation of a most interesting organism and the explanation of a new and refined method of research, which promises to yield results in fields far removed from that in which it was developed. The lecture given by Prof. E. N. Harvey on luminous bacteria was all of these. Any phosphorescent organism is a show for biologists and, when the lights were turned off, luminous bacterial colonies on agar slants, bacterial emulsion which gave enough light to tell time by and glowing cultures in pie-plates, which were used as Petri-dishes, were shown the audience.

Luminous bacteria unlike the phosphorescent organs of certain animals glow continuously as long as there is free oxygen available; in its absence they lose this luminescence. Thus a culture will serve as an indicator and will by its glowing indicate the presence of free oxygen.

It is of course impossible to tell how much of our present scientific progress is due to an increasing accuracy of measurement. Certainly many fields of most fruitful investigation, which were closed to biologists, who knew the solutions they investigated merely as acid, basic or neutral, were opened by the development of a more precise method of measuring pH. An increased delicacy of indicators for other factors is almost certain to extend our knowledge in fundamental ways.

The importance of oxygen in the life process is recognized. Its detection in even the most minute amounts is necessary for the solution of many problems. Are certain anaerobic organisms really anaerobic or will they tolerate free oxygen in amounts smaller than we have yet been able to measure? How much light is needed by green plants for the assimilation of carbon and hence the release of oxygen? What is the oxygen supplying power of a clay soil three feet under a swamp?

The delicacy of these luminous bacteria as an indicator is shown by the fact that light is produced by only .0053 mm. Hg. oxygen tension. The light from a single match can certainly cause no great amount of photosynthesis to take place, yet a piece of marine alga immersed in an imulsion of these luminous bacteria will produce enough oxygen to cause a glow when it is subjected to this amount of light. A like evidence of photosynthesis can also be found under circumstances where it would hardly be expected to take place. The liberation of oxygen by the exposure to light of leaves which have been ground up, frozen and thawed again, dried and again moistened can also be proved.

It can readily be seen that the luminous bacteria constitute a most useful tool for future investigation.

(Continued from Column 1)

CHORAL SOCIETY WILL PRESENT CONCERT SOON

The Woods Hole Choral Society will give a concert in the M. B. L. Auditorium on Monday evening, August eighth. The Choral Society was organized last season and during part of last season and this summer has been working hard under the able directorship of Mr. Gorokhoff. Mr. Gorokhoff trained the famous Russian Choir which delighted audiences in Woods Hole several years ago. He is now Professor of Music at Smith College.

The program will contain a variety of carefully selected pieces, including Russian and Scotch folk songs, and sacred music.

Fisheries Thursday Night Round Table

The staff and investigators of the Bureau of Fisheries Laboratory met for the regular weekly discussion of research problems in the parlors of the residence Thursday evening. The staff, investigators, and the students of the M. B. L. were invited to participate.

The general topic of discussion was marine fishery investigation and Dr. O. E. Sette gave a talk on "The mackerel fishery and biological aspects of its fluctuations".

Lillie's Summary

(Continued from Page 1)

whole, and (c) of determinate qualities coordinated both in space and in time.

4. There is a final term in each of the branches, which is followed by histogenesis and definitive functional differentiation, though certain terms (or branches) remain open throughout life. We may thus distinguish closed and open terms throughout the life history with reference to embryonic segregation.

Each of these characterizations was then discussed, and the problem of embryonic induction came in for special consideration, leading to the conclusion that all examples served to show that induction produces only the phenotype for which ontogenetic segregation had prepared the way; that the specificity of the response lies in the stage and locus, not in the inducing agent, and that the possibilities for any induction arc only two in number. This simple situation is often confused by two prevalent ideas, the one that potencies may be more than two in number at one time and place; the other that the inducing agent may have determining value, i. e. be a so-called formative stimulus. The fallacies of these positions were exposed.

An adverse position was taken concerning the formative stuff hypotheses of development generally, and also against the vague idea of referring development to autocalysis. Metabolism furnishes the energy of development, but its varying kinds are to be regarded primarily as chemical indicators of differentiations already accomplished, and only secondarily, as in the case of hormones, as factors of differentiation.

The processes of ontogenetic segregation may lead to *closed terms* at their end, i. e. tissues and cells said to develop by self-differentiation; or in certain lines of ontogenetic segregation the terms may remain *open*, and the cells retain a double potency throughout life as e. g. in the feather germs of sexually dimorphic birds, or in cells of the nervous system. These are to be distinguished from the alternatives of any action system, which are reversible, as contrasted with the irreversible character of ontogenetic segregation.

The space relationship in development as such appears to be resolvable into physiological terms whether of gradients or induction. However, the time sequence of developmental processes remains an unanalysable feature of the life history. At each stage of the ontogenetic process specific forms of reaction, whether of the whole, or of its parts, occur. The order is invariable, at least within any given system and has not so far been experimentally modified.

In the second part of the lecture the bearing of the theory of the gene upon the above aspects of development was considered. Genetics contributes largely to the conception of the germ; but is helpless so far as the theory of individuation is concerned. With reference to the phenomena of embryonic segregation genetics is the victim of its own rigor. If each cell receives the entire complex of genes, it is self contradictory to attempt to explain embryonic segregation on the gene theory. Goldschmidt's attempts in this direction were characterized as a rather splendid failure.

On the other hand in all phenotypical realization, i. e. in the objective appearance of any character at any stage, the genes undoubtedly play a decisive role. The genetic problem differs from the embryological problem inasmuch as any definable character at any time in the life history may be treated as final for genetic study, and examined with reference to its modes of recurrence in successive generations. One cannot imagine at the present time any other experimental technique that would even remotely approach in delicacy of treatment to the superlative refinement of modifications of the gene system that the genetic method renders possible. It is an indispensible method for phenotypical analyses, whether in a genetic or a physiological sense. But it has its limitations, physiologically considered, arising from the necessary finality of treatment of any character, and from our complete ignorance either of the chemical nature or mode of action of the genes.

The necessary postulate of genetics is that the genes are always the same in a given individual, in whatever place, at whatever time, within the life history of the individual, except for the occurrence of mutations or abnormal disjunctions to which the same principles then apply. The essential problem of development is precisely that differentiation in relation to space and time within the life history of the individual which genetics appears implicitly to exclude.

The phenotypic identity of environmental modifications of given characters and of gene modifications of the same characters was then emphasized. This is explicable on the assumption that both act on a given ontogenetic process.

Physiology of development and genetics both teach us the same lesson, viz, that at the foundation of any given phenotypic event there is an unanalyzed ontogenetic process, which expresses itself in time by qualitatively different types of reaction, whether to the environment or to the gene, or to both combined. This is the unrecognized presupposition of all studies in either field. This process is deterministic, and open to observation and experiment like everything else occurring in nature.

The life history exhibits a duality expressed in the associated phenomena of ontogeny and genetics: on the one hand the genes which remain the same throughout the life history, on the other hand the ontogenetic process which never stands still from the germ to old age. Physics and chemistry have no place among their categories for the ontogenetic process, and *a fortiori* for the phylogenetic. Why not surrender ourselves, in consideration of these problems, to the current of more naive biological categories?

Hoadley Review

(Continued from Page 1)

place, given a germinal duality, *viz.*, cytoplasmic and nuclear, and admitting both species and individual specificity in development, it follows that any alteration in genetic constitution, be it of nuclear or cytoplasmic elements, must result in developmental differences. It might be added that, at least in the higher so-called non-determinate types, environment plays a very important role, of which I shall say more below.

In discussing differentiation, Prof. Lillie distinguishes two general varieties, one of which involves the origin of germinal localizations, embryonic segregation, and the other of which is concerned merely with the elaboration and realization of potencies in already definitely localized and determined areas. It would seem at the present time that all eggs have one property in common. (I refer here to polarity.) Subsequent embryonic segregations bear a definite relationship to this main, and future subordinate axes of the germ. While this spacial relationship is definite, it is no more so than the temporal relationships exhibited during ontogeny.

Just as cellular differentiation implies an increase in the complexity of the cell, so embryonic segregation implies an increase in the complexity of the germ. We have just seen that the determinate qualities of embryonic segregation are coordinated in space and time, and they must, of necessity, also involve genetic restriction in the sense in which Minot used the term. It is also very evident that the course of the process always runs from the generalized to the more specialized during the development of the individual.

This, the lecturer believes, is accomplished by a process which is both dichotomous and discontinuous. No one who is familiar with the immense amount of available information on cell lineage can doubt the truth of this hypothesis here, though there are those who, perhaps, cannot appreciate the dichotomous nature of the process in the higher forms. Recognizing this, Prof. Lillie has presented an immense amount of data in support of this view which would appear, on careful examination, to be the only one which will explain the facts. The confusion is apparently due to the fact that while the consideration of potencies in question really involves only the immediate segregations, all those which may subsequently arise are not rightly to be included. Here we should fix our attention on ehe reaction of the substrate to the inductive factor and consider the temporal arrangement as well as the spacial.

I have spoken above of the part which environment may play in the fate of areas in open term. This is a very important fact which depends upon the truth of the above statements for its validity. The environmental factors which are effective in changing the type of differentiation of parts of an individual are those which involve its position in the individual as a whole, and consequently the type of inductive influence to which it will react. All of the experiments on amphibian transplantation in the early stages emphasize this. Mangold has very aptly described it as "Ortsgemasse Entwickelung". We might speak of it as positional development. This is supported by all of the data on independent self-differentiation which, in itself, indicates the presence of elements in final term. The author has emphasized the point that some of the elements in the individual remain in relatively open term throughout life, which gives plasticity to the individual during the later stages of the ontogenetic process.

There is another implication of the closed and open term hypothesis which is very significant and would seem to be an important truth in the light of many recent experiments. I refer here to the inability of cells to undergo retrogressive differentiation in the sense of reversals of embryonic segregation and the limitations placed upon them when in the final stages of open term, or, for that matter, at any time during this process of genetic restriction. This will be recognized to involve the distinction between dedifferentiated and indifferent cells.

In concluding his remarks, Prof. Lillie pointed out the reasons for the failure of the gene theory as it stands at the present time to make significant contributions to the physiology of development as far as the embryonic segregation of potential areas is concerned. The most evident is the fundamental hypothesis that each daughter cell receives qualitatively and quantitatively the complement of genes which was present in the mother cell. With this hypothesis it is impossible to explain the action of these elements in development without referring immediately to the character of the substrate. Hence we find the same problem presented as to the origin of the specific substrates and the way they are made susceptible to gene influence, that appears in a slightly different form in the case of embryonic segregation. That there is a genetic influence, no-one would deny, nor would anyone deny that this may become evident at various definite times in the life history of the individual, but the theory admits only the causal factor, the gene, and the end result, in the form of the influenced character. At the present time, therefore, both genetics and the physiology of development find themselves confronted by the need for the answer to the question: What is the cause and method of embryonic segregation?

Mrs. Edmund Osbourne, daughter of the late Jacque Loeb, visited in Woods Hole recently.

Dr. Warbasse has sailed on board S. S. "Stockholm" for Gotenborg, Sweden, on July 30 as a delegate of the International Cooperative Congress to be held in Stockholm, Sweden on August 15. On its conclusion he intends to take a three weeks skiing trip in the snow and the glaciers of Norway. His son Eric will accompany him. They are expected to return on September 10.

ASTRONOMICAL LULLABY

Twinkle, twinkle, little star!
Chemists know just what you are;
Though your carbon content's high,
You're no diamond in the sky.

Helium and hydrogen
Form a part of you, we ken,
But your heat is much too great
For carbon in its crystal state.

And your spectral lines, beside,
Tell a tale you fain would hide;
If you're sixty or sixteen—
Billion years, of course we mean.

These same lines, by twisting, prove
How and with what speed you move—
Watch your step, star, and beware
The spectro-telescopic stare!

Stars there are, we might remark,
Having ways unseen and dark;
The astronomer contrives
To find some leading double lives.

Betelgeuse, Orion's pride,
Lay false modesty aside;
By interference telescope
Michelson has sized you up.

Twinkle, twinkle, little star!
We know just how warm you are,
By your color red or blue—
We've your number, indexed too.

pH. D.

The Collecting Net

A weekly publication devoted to the activities of the Marine Biological Laboratory and of Woods Hole in general.

(Application for entry as second-class matter is pending.)

The Universal Press
New Bedford Woods Hole
Massachusetts

The Scholarship Fund

We are glad to make note of another contribution of ten dollars to the "C. N. Scholarship Fund". We have now received a total of fifty-five dolars. This is one quarter of the sum that will be divided into two scholarships of one hundred dollars each. They will be awarded to two financially embarrassed and deserving students to make it possible for them to return next summer and work on a research problem at the Marine Biological Laboratory. The awards will be made during the first week in September by a committee composed of five persons in charge of the classes.

LILLIE, FLEXNER AND WASTENEYS, ELUOGIZE LOEB AND HIS WORK

A dedication ceremony in honor of Dr. Jacque Loeb, was held Thursday afternoon, August 4th in the auditorium of the brick building, and a bronze plaque commemmorating Dr. Loeb was placed in the lobby of the laboratory next to the Whitman plaque and unveiled at the time of the ceremony.

The speakers of the afternoon were Dr. Frank R. Lillie, former director of the laboratory who spoke on Dr. Loeb's connection with the M. B. L.; Dr. Hardolph Wasteneys of the University of Toronto who spoke on certain phases of Dr. Loeb's work; and Dr. Simon Flexner of the Rockefeller Institute who spoke on Dr. Loeb's connection with the Institute.

Dr. Lillie spoke of the history of the laboratory in connection with Whitman and Agassiz whose names had been placed, like Loeb's, in bronze on the walls of the laboratory. He also told how Loeb had designed and used for so many years the little wooden laboratory which now stands next to the botany building. During Dr. Loeb's life the building stood on a site near the edge of the Eel Pond, and was moved after Dr. Loeb's death in 1924 to its present place.

Dr. Wasteneys spoke on Loeb's work on proteins, since it was impossible to discuss or even mention all of the fields in which he worked. He brought out the importance of the work on proteins and the simplicity of Loeb's methods and apparatus. Those problems which Loeb was unable to solve he would often set aside for years until science, or apparatus, or his own knowledge caught up with the problem and he was able to go ahead with it. Loeb did all of his work with unusually simple apparatus, in contrast to the elaborate methods so prevalent among laboratory workers, according to Dr. Wasteneys.

Dr. Simon Flexner, head of the Rockefeller Institute, spoke of Loeb's connection with Rockefeller from 1910 when the Institute was able to persuade Loeb to desert his teaching for the research position, to 1924 when he died. Dr. Flexner discussed Loeb's own history and the influence of the great scientists of the past century with which Loeb had come in contact. He was a graduate of the University of Strassburg, and in his younger days was taught by Fick, Golz, and Sachs. From Sachs he had become interested in tropisms and did much of his later work or tropisms in animals. These teachers who had come under the influence of such men as Helmholz, Pasteur, Nernst and a score of other great physiologists of the 19th century, passed on much of their influence to Loeb. It was this inspiration, according to Dr. Flexner, as much as anything else, which made Loeb the great factor that he was in the Rockefeller Institute. Flexner told of the enthusiasm felt for Loeb by the younger men of the laboratory, how eager the members of the Institute were to sit at Loeb's table because of his brilliant conversation and his ability to inspire. If Loeb had done nothing more than to inspire he would still have done tremendous service to the Institute, said Dr. Flexner. Dr. Loeb's death occurred suddenly in 1924 at the height of his scientific career.

NOTICE

Many of the books appearing on the shelves in the "new books" corner of the reading room have been presented to us by the publishers with the provision that we let them know of the number of sales that their presence in our library may have brought about. We cannot do this without your cooperation. Will you be sure to tell us on the slip at the end of the bookcase of any new books you have learned about here and have recommended for your own library's purchase.

The library must have a complete set of your reprints. How can you help the staff to secure these?

To follow up the point about reprints that was recently made, are you willing to do one of two things?

(1) Make a note of your reprints that we already have, by listing these from the catalogue that is on the same stack floor as the reprint collection (if there are many of these, we will be glad to do this for you). When you are in your own laboratory in the fall, compare this list with a complete list or collection that you may have of your own reprints. Then send us those that we lack along with a complete bibliography of your papers, chronological if possible.

(2) Hand to us a chronological bibliography of all of your papers. We will return this to you checked to show those that we already have. When you are in your own laboratory in the fall, return the list to us with those reprints that we lack.

Please bear in mind that it is most desirable that you should place not one set, but a duplicate set of your reprints here. Please place the Marine Biological Laboratory Library on your mailing list for two copies of all current papers that you issue.

Librarian,
Marine Biological Laboratory,
Woods Hole, Mass.

To the Editor:

May I claim just enough space to praise a feature in your *Collecting Net* which has appealed especially to me? Being hard of hearing I have unfortunately been compelled to forego the pleasure of attending the lectures in *persona propia* and of getting each speaker's message directly from him (or her, if there be such!) Therefore your published abstracts and reviews, written clearly and with generous appreciation of faithful work well done, are a real delight to me and must be so to others handicapped as I am.

Dr. Alfred Meyer,
Woods Hole, Mass.

Protective Association Meets Friday Evening

The annual meeting of the *Woods Hole Protective Association* will be held in the Old Lecture Hall on Friday evening, Aug. 12 at eight o'clock. All members are urged to attend.

The Woods Hole Protective Association is an organization of householders at Woods Hole formed about six years ago for mutual protection against breakage and theft during the winter months, and for the furtherance of all measures directed toward adequate police and fire protection. The Association employs an inspector who examines the exterior of each house on the Association's list once a week while it is unoccupied, and reports immediately any evidence of attempted burglary or other damage. In addition the Association offers a standing reward of $100.00 for information leading to the arrest and conviction of any offender.

The present officers are: President Dr. H. H. Plough, Secretary Miss Florence Tuckham.

Any householders who wish to join the Association are urged to attend the meeting.

To the Editor:

We have just received the July 23rd issue of the *Collecting Net* and are very much interested in the description which you give of the early history of Woods Hole and also of the details of the present management of the organization. We are very much pleased with your friendly reference to our firm as given on page 11.

We wish, however, to call your attention to the fact that our firm is not in any sense a German firm, except that the founder of the firm who was the assistant of Liebig in Germany came to this country in 1848 with the thought of being a professor of chemistry at Harvard. As he had no money to get from New York to Boston, he remained in New York to earn sufficient money and becoming interested in the work remained here and eventually organized the firm of Eimer & Amend. We are enclosing introductory section of our BCM catalog where these details are given.

Please note, however, that no German money was ever invested in this company, and also that the present members of the firm, and in many cases their parents, were born in this country. While originally a large portion of the chemical laboratory apparatus and chemical reagents were imported from Germany, the amount imported at the present time is very small and the materials which we supply are in general manufactured in this country. Exceptions are Zeiss Microscopes, S. & S. Filter Paper and some German glassware.

Again assuring you of our appreciation of your kind reference to our firm, we are

F. Wilbur Shulenberger,
Eimer and Amend
New York, N. Y.

THE SIX BLIND MEN AND THE JELLYPHANT

Apologies to John G. Saxe

There were six men of chemistry
To research much inclined,
Who went to see the Jellyphant
(Tho all of them were blind)
That each by observation
Mgiht satisfy his mind.

The first approached the Jellyphant
And happening to note
Its thirst for acids, bases too,
At once began to gloat—
"I see," quoth he, "the Jellyphant's
An ampholytic goat."

The second, happening to touch
The amino-acid paws,
Said—" 'Tis a biped, without doubt—
Obeys all biped laws.
Ridiculous to speak of it
As running on all fours."

The third said—"Every mother knows
Why mayonnaise stands up.
Well-made emulsions won't fall out
If you invert the cup.
'Tis plain to me the Jellyphant's
An emulsoid-colloid pup."

"I fell such firmness," said the fourth,
"That seems to indicate
The beast a solid backbone has—
I see it sure as fate!
This Jellyphant is nothing but
A suspensoid vertebrate."

The fifth deaminized its arms,
But still it quenched its thirst.
"Ha, ha," he cried, "a hootch-hound sure!
Deny the fact who durst?
A keto-enol chamelon this—
Of all I've seen, the worst!"

The sixth immersed the Jellyphant
In water without malt.
Sober, it sang H ion hymns,
In tune, without a fault.
He sighed, and cried—"This maligned beast's
An orthodox old salt!"

And so these men of chemistry
Disputed loud and long,
Each in his own opinion
Exceeding stiff and strong,
Tho each was partly in the right
And all were in the wrong.

Thus oft in scientific wars
The disputants, I ween,
Rail on in utter ignorance
Of what each other mean,
And prate about a Jellyphant
Not one of them has seen.

pH. D.

Dr. Hallowell Davis, assistant professor of physiology at the Harvard Medical School, was a recent visitor to Woods Hole. While here he gave a lecture on nerve conduction to the physiology class.

Currents in the Hole

At following hours the current in the hole turns to run from Buzzards Bay to Vineyard Sound:

	A. M.	P. M.
Aug. 6	11:27	11:56
Aug. 7		12:12
Aug. 8	12:51	1:06
Aug. 9	1:43	1:56
Aug. 10	2:33	2:46
Aug. 11	3:23	3:34
Aug. 12	4:14	4:21
Aug. 13	5:01	5:14

In each case the current changes six hours later and runs from the Sound to the Bay.

Dr. J. G. Wheatly, professor of engineering at the Carnigie Institute of Technology died in June. Dr. Wheatly and his family have spent many summers at Woods Hole.

Professor Thomas Hunt Morgan has returned from an absence of about two weeks, during which time he visited the laboratory at the Tortuga Islands.

Reminiscences of the Fish Commission

(Continued from Page 1)

had been connected with the scientific work of the Fish Commission from its first organization.

There was some delay in 1882 in getting started with the work at Woods Hole, and I took advantage of this delay to accept an invitation from Professor James D. Dana to accompany him on a geological trip into the Berkshire Hills. We went by rail to Canaan, Connecticut, and then with horse and buggy drove through the region embracing Great Barrington, Lee, Lenox and Stockbridge. We spent the 4th of July at Canaan, where I had my first experience with a New England celebration of the day. I was much impressed by the noise and other evidences of enthusiasm. Toward evening the street in front of the hotel was pretty well filled with patriots, who, I was told, had come from some neighboring point. They were shooting off pistols with enthusiastic abandon, and by their walk and conversation gave evidence which in these days might be interpreted as indicating the near presence of a bootlegery, but in those days was a not unusual happening in the vicinity of a hotel bar. I still think of Canaan, Connecticut as a place:

Where every prospect pleases—

It was about the first of August when we reached Woods Hole. I remember very well my first meeting with Professor Baird. It was in front of the house facing Little Harbor, which was occupied by him and his family, and where the laboratory and clerical force took their meals. I am not sure whether it was called a mess in those days or not, but my impression is that it was so-called. As I recall the picture of that scene I see Professor Baird as an elderly man, of large frame, with a slight stoop, wearing a beard, but with his upper lip cleanly shaven after the fashion of those times. I realize that the picture is one recorded by young eyes, for it is with something of a shock that I note the fact that at the time at which I am writing this sketch, I am older by several years than Professor Baird was at the time of his death which did not occur until five years after the date upon which I first met him.

He questioned me as to what zoological work I had been doing, and wanted to know what group of animals I was especially interested in. I soon learned that he thought that the best approach to zoological work was first to become familiar with some group of animals. Such familiarity was not to end with the ability to give names to a large number of representatives of the group, but inferred intimate first hand knowledge of morphology, geographical distribution, habits and the like. Indeed, as I recall subjects of conversation which I heard discussed by Professors Baird, Verrill, Smith, G. Browne Good, Theodore Gill and others, systematic zoology formed but a small part. It is true that for the most part their concern was with questions of what and where and how and why, but it did not stray from the solid ground of nature. Of a different sort were the monologues of John A. Ryder with which he now and then favored us younger men. I am inclined to think that if some of the more inspired of these could have been taken down as they were spoken, they would have been worth-while contributions to speculative interpretation of the cosmos.

In 1882 and until the summer of 1885 the Fish Commission laboratory was housed in a two story frame building on the buoy wharf of the Light House Service in Little Harbor.

It stood where the present brick building now stands. I have not verified my belief, but I think that the frame building which stands north of the brick building, is the one which was used for the laboratory, and was moved to its present site to give place to the brick structure. There was a frame building on that site, but as I remember it, its appearance was quite different from that of the one which now occupies the site.

The first floor accommodated those whose work had to do mainly with fishes, the second was occupied by those who were engaged for the most part in work with invertebrates. This laboratory, to which access was had by means of an outside stair way, accommodated, as I recall, ten work tables. Here work was in progress from early morning until late at night. The younger members of the party spent much time collecting material in the various ways familiar to those who have taken the invertebrate course in the Marine Biological Laboratory. One of our methods of making surface collections has left an impression on my memory. That was to take the steam launch, *Cygnet*, and make fast to the large can-buoy in the "Hole" when the tide was running, and there tow for a half-hour or more. The towings were taken to the laboratory and there looked over before leaving for the night.

Reminiscences of the Fish Commission

(Continued from Page 8)

As I look back upon those days I am impressed with the almost total absence of anything in the way of play, other than the daily swim which most of us took. Professor Verrill was an indefatigable worker who got along with but a few hours of sleep. His habit of close application to work continued unchanged until near the end of his life, which was but a few months ago. An interesting account of his life work, written by Professor Wesley R. Coe, appeared in a recent number of *Science*. Another example of painstaking and efficient industry was set us younger men by Richard Rathbun. I was glad to hear his work given high commendation recently by Dr. C. B. Wilson, who has for many years been working on the group which Rathbun was investigating in the eighties.

Two or three days after our arrival at Woods Hole (then, and for some years spelled Woods Holl) the *Fish Hawk* was sent on a dredging trip off the coast from Monomoy to Provincetown. As this was my first trip on the *Fish Hawk* I am naturally better able to recall my experiences and sensations on this occasion than I can do for any of the many trips which I made on this vessel later.

Fortunately the sea was calm and none of the unpleasant memories which are usually associated with dredging trips on the *Fish Hawk* arise. I remember, however, that as we were lying at anchor the first night out, I was kept awake for some time by a peculiar rattling sound somewhere near my berth, which kept time with the gentle rolling of the ship. I learned later that the sound was caused by a lot of loose shot in a thermometer which was used in getting depth temperatures. The thermometer happened to be lying athwart-ships so that the shot rolled from one end of the tube to the other with each change in the position of the ship.

Our first dredging wass off Chatham. I remember particularly the fine specimens of the many-branched ophiuran, Astrophyton, and a large species of sea anemone, both of which were taken in considerable numbers.

It was on this trip that I made the acquaintance of two interesting characters, Captain Z. L. Tanner, and Captain H. C. Chester. Captain Tanner, Commander of the *Fish Hawk* was a typical, bluff, ruddy-faced seaman, who might have stepped out of one of Maryatt's novels. His voice was rather harsh, and he used it in such a way as to make repetition of an order quite unnecessary. I listened to him on this trip while he was drilling a boatswain, a Swede, at the wheel. When the lesson was ended, which would have left an ordinary man a nervous wreck, that placid Scandinavian had been put through a succession of manouvres, which, as it seemed to me, were calculated to afford practice in about every possible contingency in navigation. Captain Tanner, while a strict disciplinarian, was absolutely fair and just, and was well liked by the crew.

Captain H. C. Chester at this time was an active man of about 48 years, abounding in energy and good humor. His training from early years had been in the whaling service, in which he had been rapidly promoted. The rigorous discipline of this exacting calling had fitted him admirably for the position of executive officer on the arctic expedition under Captain Hall on the unfortunate steamer *Polaris*. He had joined the Fish Commission in 1874, soon after his return from the Polaris expedition, and took part before his death, in 1886, in nearly all the branches of the service. He had charge of all dredging operations other than those carried on by the steamer *Albatross*, which was not yet in commission in 1882. Those of us who fell under the spell of his robust gayety could well understand how he had met with success in conducting to safety that portion of the crew of the *Polaris* which had drifted to sea on the detached ice-floe. Our attempts to get him to talk about his arctic experiences failed. He preferred to talk of pleasanter life experiences, of Noank, Connecticut, a name which he pronounced much as a devout Mohammedan, I imagine, intones the word Mecca; of an orchard on a steep hill-side on his father's farm, from which the apples did not roll down on the neighbor's grounds below because they were flat on one side.

We spent the second night on this trip in the harbor at Provincetown. Three of us rowed across to the point where there was then vast accumulations of the bones of whales which had been taken off the coast and brought in to the shore try-works. We were allowed to take such specimens as we desired. My share of spoil from this raid was a rib, a vertebra and an intervertebral plate.

During the remainder of the season a few trips were made in the *Fish Hawk* to the Gulf Stream. On these trips we started in the evening, steamed all night, and began dredging early the following morning. In 1882 the dredging was on the continental slope. This area is rich in living forms, and the net of the trawl usually came up loaded with a great variety of annelids, crustacea, echinoderms and mollusks, and not a few fishes. The temperature of the water at the surface, at the bottom and, occasionally, at intermediate depths, was taken, and the character of the bottom was noted. I remember that among bottom specimens which I carried home with me were some samples rich in foraminifera brought up by the *Albatross* in 1883. Later some small fragments of a limestone which, in Western Pennsylvania lies about 1100 feet below the Pittsburg Coal Bed, were obtained from one of the oil wells in Washington, Pa. When thin slices of this material were made it was manifest that the rock from which they had come had been built up of practically the same kind of material as the material which had come from the bottom of the Atlantic Ocean off our coast and at a depth of over 1000 fathoms. When I set these two facts before my classes, as I did annually for a long series of years, the one e v i d e n c e brought from the crust of the earth some 1600 feet below the college buildings, and in a stratum of the Mississipian formation, the other, from the bottom of the Atlantic Ocean, and belonging to our own age, I tried to pass on to my classes some of my own reactions; the vast abyss of time which separated these symbols, the implications to be drawn therefrom, and a comparison with our own brief adventure in time. So far as I could see these reflections were received by the students with undisturbed calm.

On one of the trips to the Gulf Stream in 1882 lines were put out and left for several hours in an attempt to secure specimens of the tile fish. A great many fish of different kinds were taken in this way but there were no tile fish among them. It was the hope of Professor Baird that the tile fish had not been completely destroyed, and that ultimately the tile fish grounds might become a valuable source of fish food.

My published reminiscences were concerned for the most part with the years 1882-1887. It would be too heavy a tax on the capacity of *The Collecting Net* for me to attempt to speak in detail of those who crowd upon the scene as I think over the years which have marked my acquaintance with the laboratory of the Bureau of Fisheries. In the summer of 1889 I recall as I write that there were working in the laboratory: E. A. Andrews, R. P. Bigelow, W. K. Brooks, E. R. Boyer, C. B. Davenport, M. C. Greenman, C. F. Hodge, F. C. Herrick, T. H. Morgan, Sho Watase, H. V. Wilson, and W. M. Woodworth. There may have been others whom I do not recall, but any one who contemplates this list must realize that it was rare good fortune that brought one into such fellowship.

Of the years between 1889 and 1898 I cannot speak from personal knowledge of the progress of events at the Bureau of Fisheries Laboratory at Woods Hole.

Conservation Work of Bureau of Fisheries

(Continued from First Issue)

This brief outline of the purposes and activities of the Bureau will be sufficient to show that its primary purpose is the conservation of our fishery resources. It is pertinent, therefore, to inquire just what is meant by *conservation*. This much abused word does not mean merely *saving*, although it is probable that in the popular mind the two words are synonymous. It may be said that conservation involves as much the utilization of a resource to the fullest possible extent compatible with its perpetuation, as it does the preserving of the resource against undue exploitation.

A greater appreciation of the necessity for conserving our fisheries has undoubtedly been brought about by the serious depletion of some of the most important of them. The sturgeon have all but disappeared from both coastal and inland waters; the salmon of the Atlantic coast have been entirely exterminated or seriously diminished in number in many streams, and in certain streams on the Pacific coast the salmon are much reduced; the halibut on both coasts have been distinctly reduced in numbers, unquestionably as a result of overfishing; the shad and mullet of the east coast and the whitefishes and related forms of the Great Lakes have been affected; and the production of oysters has fallen off.

Division of Scientific Inquiry

The work of the division of scientific inquiry is exceedingly diverse. A large measure of effort is devoted to biological studies of important food fishes and of other animals such as oysters, crabs, clams, etc., which yield important aquatic products. The scientific investigation of the fisheries, or of the fish on which the fisheries are based, provides data essential for the proper conservation of the resources. We must have information relative to such fundamental facts as the rate of growth, age at maturity, time and manner of spawning, habits of the young, feeding habits of both young and old, extent and direction of migrations, and the extent to which the various groups of fish mingle, particularly with respect to their interbreeding. A considerable amount of attention is given to enemies or other elements in their environment which tend to reduce the abundance of those forms from which we obtain our fishery products. Such studies are commonly known as "life-history studies" and considerable attention is paid to investigations of this nature. As an aid to the work of artificial propagation, studies are also conducted dealing with the pathology and nutrition of fishes.

The oyster industry of the Atlantic coast is one of the most valuable fisheries, annually yielding about $14,000,000 worth of products. It is prosecuted in every coastal state from Massachusetts to Texas, but in many localities it has declined to an alarming extent, the total decrease in yield in the last 20 years amounting to almost 60 per cent. The bureau has been investigating the causes of this depletion and has found that it is largely due to pollution combined with the over-fishing of the natural oyster beds close to shore. During the first two weeks of its life the young oyster is a very delicate microscopic animal and is free swimming. At this stage in its life it is very easily killed by such adverse conditions as are brought about by the pollution of the coastal waters. It is also true that oysters do not set free their eggs until the water in which they are living has warmed up to a temperature of approximately 70 degrees. Frequently in the North the deeper water fails to become sufficiently warm for spawning to occur in any appreciable quantity. As a result the seeding of the beds out from shore depends to a considerable extent upon the successful spawning on those inshore. The young oysters drift with the currents from there onto the offshore beds, settling down there and under favorable conditions, they reach maturity. Thus it may be seen, that, in certain localities such as the Long Isand Sound region, the success of oyster culture is dependent on the successful spawning of oysters close to shore. Unfortunately this is where pollution is most abundant and where the young free-swimming oysters have the poorest chance for survival. There is apparently little possibility for improvement in this fishery until the pollution problem has been remedied.

Despite the fact that the oyster has been cultivated for hundreds of years and is one of the best known mollusks there is a surprising lack of exact information concerning its life history. These problems are being attacked in a systematic manner at the Bureau's Woods Hole laboratory.

The great salmon fisheries of the Pacific constitute our most valuable fishery. A large part of the product comes from Alaska, where during 1926 there were over $62,000,000 invested in this industry. The product from Alaska alone was valued at more than $48,000,000. The care of this great industry is vested in the Department of Commerce and is administered by the Bureau of Fisheries. In order to properly regulate this fishery extensive studies have been carried on for a number of years. As a result it is probable that the life histories of the several species of salmon are better known than those of any other important food fish. We know, for instance, how rapidly the fish grow and their size at maturity. The so-called parent stream theory has been firmly established as a fact of wide application. The parent stream theory merely states the fact that the salmon, after spending several years in the ocean where they feed heavily and grow rapidly, return for the purpose of spawning to the same stream from which they came as young fish. Salmon lay their eggs in fresh water and the young fish, after hatching and sometimes living in fresh water for one or more years, make their way to the ocean where they live until mature. The problems connected with the conservation of the salmon fishery thus assume a very different aspect since it is at once apparent that if the run into any particular stream be destroyed, it can only be restored after a long period of time or by extensive and successful artificial propagation.

The extent to which salmon wander from their parent streams is also a matter of importance for although a run of fish may not be in danger as a result of fishing operations in the region about its native stream, there may be a fishery established at some distant point which attacks the same run of fish and causes depletion. In an investigation of this problem the bureau has tagged thousands of adult salmon in the region about the Alaska Peninsula. One of the most significant things which developed from this work was the fact that the fish which formed the most important part of this fishery came from Bristol Bay where there is another great and intensive fishery. Thus the fish native to Bristol Bay were being attacked at two points. Such information has been used in providing regulations governing the salmon fisheries of this region.

In a somewhat similar manner the cod of the Atlantic Coast are being investigated. We are learning many important things about their life-

(Continued Next Week)

Program of Plays

The M. B. L. Club and the M. B. L. Tennis Club
present
The Annual Benefit Entertainment
Auspices: Marine Biological Laboratory
M. B. L. AUDITORIUM — AUGUST 6, 1927, 8:30 P. M.

1.—CONCERNING TROUSERS

A scene from "Penrod and Sam" by Booth Tarkington

CHARACTERS

Penrod .... Frederick Copeland
Sam .... Seymour Edwards
Herman .... Peggy Clark
Verman .... Vicky Glaser
Gipsy (The Cat) .... Manton Copeland, Jr.
Duke (The Dog) .... Penelope Lewis

Scene: The Schofield's back-yard.
Director—Preston Copeland. Scenery—Comstock Glaser.

2.—INSTRUMENTAL MUSIC .... The Penzance Trio

3.—"A QUESTION OF PRINCIPLE"—a comedy by Martin Flavin

CHARACTERS

A Man .... L. B. Vreeman
A Banker .... C. E. McClung
A Clergyman .... C. H. Scheidt
A Judge .... L. S. Powell
A Communist .... G. S. De Renyi
A Policeman .... K. C. Blanchard
A Girl .... Miss R. F. Harrell

Scene—A Sidewalk
Direction—R. N. S. Whitelaw

4.—M. B. L. VAUDEVILLE CIRCUIT

Director—P. Reznikoff

A. Professor "Bantam" Blanchard, The Wonder Worker
B. "We" Kenneth Cole and his machine—Stepping on it.
C. Power, Stabler and Uke—in Songs of Home and Hearth.
D. "Tea for Several" by Dorothy Blanchard

CHARACTERS

Mrs. Queen .... "Roberta" Stabler
Mrs. Green .... Josephine Danforth
Letitia .... Louise Thorne
Edward .... Dick Blumenthal
Dr. Sells .... Herman Field
Dr. Goof .... Joe Hale

Orchestra—Piano, Frances M. Clark; Saxaphone, Frank Lillie; Clarinet, Norman Steele; Banjo, William Bartholemew.

COMMITTEES

Production—Mrs. E. L. Clark, A. Keefe, Mrs. F. Swett, L. M. Schmidt.
Stage, Scenery, Costumes—F. E. Chidester, C. Packard, S. E. Pond, E. A. Martin, F. H. Swett, R. C. McGoun, Elsa Keil, Mrs. Edwin Linton, Mrs. M. Copeland, Mrs. I. F. Lewis.
Business—E. R. Clark, R. Bennitt, D. J. Edwards, Mrs. W. K. Farr.

Club Plays

(Continued from Page 1)

The second play will be a Comedy—"A Question of Principle", by Martin Flavin. Between the two plays the Penzance Trio will render several musical numbers.

The last half of the evening will be given over to the recently organized M. B. L. Vaudeville Circuit—with four sparkling numbers under the direction of Dr. P. Reznikoff.

Professor "Bantam" Blanchard, The Wonder Worker, will give his famous sleight-of-hand performance. The next act will be entitled "We"—by Kenneth Cole and his machine "Stepping on it". The entrancing Trio: Power, Stabler and Uke will then entertain with Songs of Home and Hearth, and finally there will be given for the first (and probably the only) time an original one-act skit—"Tea for Several", by Dorothy Blanchard, the scene of which is laid in Woods Hole.

The proceeds of the plays will be used for improvements for the two clubs. During the past six years the income from plays has enabled the Tennis Club to pay off the debt on the beach courts, to replace the back-nets around the mess court. During the present season, it has rebuilt the surface of and subdrained the beach courts, an expensive procedure costing more than fifteen hundred dollars. the M. B. L. Club has enclosed the porch, thereby nearly doubling the capacity of the clubhouse; it has redecorated the interior; and has been enabled to enlarge greatly the facilities of the Club. Altogether these improvements have cost nearly four thousand dollars and a large share of this sum has been derived from the plays.

The will be no advance sale of tickets and no reserved seats. Tickets will be $.50 and $1.00 and will be on sale at the door, beginning at 7:45 P. M.

PROMOTION OF RESEARCH IS TOPIC OF CONFERENCE

A conference was held on Thursday evening, July 28 at the Marine Biological Laboratory in regard to problems of research in colleges. The meeting was called in accordance with the instructions from a similar conference held last summer. Twenty-two different institutions were represented. Dr. H. B. Goodrich of Wesleyan University acted as chairman.

Dr. M. M. Metcalf presented an informal report of the activities of the Joint Committee for Promotion of Research in American Colleges. This committee was organized as the result of a resolution introduced by Dr. Vernon Kellogg at a general session of the A. A. A. S. at Philadelphia in December 1926. It consists of representatives of various learned societies. Among the plans suggested is a recommendation for the establishment with outside co-operation of three different means of assistance. First, by small financial grants, to relieve teachers of the necessity of gainful occupation during the summer, in order that the time may be devoted to research. Secondly, to establish research fellowships for younger members of college faculties. Thirdly; to establish rotating research professorships probably one in a college. It has been suggested that such experiments be tried out first in a few colleges, preferably in different parts of the country where there is expectation that results will be satisfactory.

After a discussion of this report, statements were made in regard to conditions in various colleges. Dr. O. L. Inman reported the organization of a research committee at Antioch College which apportions a research grant made by the college.

Dr. C. G. Rogers outlined the conditions at Oberlin where a research committee of the science departments has been in existence for some time. During the last year a general committee representing all departments has been organized.

Dr. J. W. Mavor spoke of the unusual conditions existing at Union College because of support given to definite research projects by the General Electric Company. Encouragement is not limited to the field of electrical engineering.

Dr. H. H. Plough outlined the recent reorganization of M. A. work at Amherst. The old system of course requirements has been abolished and now the program of each student is made to center about some special

Serious Explosion On Hilton's "Playmate"

Those ardent scientists who spring like old fire horses to the hoot of the Woods Hole fire siren, and who are invariably to be seen steaming along in the wake of the hook and ladder, were tremendously excited last Saturday, upon emerging from the lab. to see the Woods Hole Fire Department apparently putting out a blaze in the fire house. After more careful investigation, however, it was seen that the fire was on board the "Playmate" which was pulled up to the drawbridge. Mr. Hilton, the owner of the boat, was priming the engine in preparation for one of his frequent Saturday afternoon sailing parties when the explosion took place. The cabin had been closed during the hot forenoon and it is believed that gas had accumulated and was ignited by the combustion of the engine. Mr. Hilton was rather severely burned and the "Playmate" will probably need about three hundred dollars worth of repairs before she will again be the jolly craft that has taken so many weary biologists away from their microscopes—and brought them back again.

Conference On Research

(Continued from Column 1)

piece of research. A research committee is established and the college makes grants for encouragement of special research projects.

The conditions at Wesleyan University were outlined by Dr. H. B. Goodrich. There are found means of encouragement such as research funds in certain departments, limited stenographic aid, a full time research associate in one department, a college machine shop etc. There is kept a record in the College Bulletin of all publications by members of the faculty. A research committee has recently been established.

There was a general discussion of various points raised and the following resolutions were passed:

Resolved: that this conference approves plans for encouragement of research formulated by the Joint Committee on Promotion of Research in American Colleges.

Resolved: that reports given at this Woods Hole conference show that direct results have been accomplished through the efforts of the Committee and that in the opinion of this conference it is desirable that the Committee should continue its efforts for the promotion of research in American Colleges.

THE COLLECTING NET

Volume II
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WOODS HOLE, MASS., SATURDAY, AUGUST 13, 1927

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TRUSTEES AND MEMBERS OF M. B. L. CORPORATION HELD MEETING TUESDAY

Conklin and Stockard On Executive Committee

At their meeting on August 10 the Trustees of the Marine Biological Laboratory appointed Dr. Edwin G. Conklin and Dr. Charles R. Stockard to replace Dr. Grave and Dr. Glaser whose terms automatically terminate this year.

The following individuals were elected as members of the Corporation of the Marine Biological Laboratory: T. H. Bissonette, S. C. Dellinger, T. Y. Graham, Florence Hague, P. Reznikoff, H. W. Stunkard, W. B. Unger and W. E. Bullington.

At the meeting of the Corporation which was held at noon on Tuesday, the following men were elected to the corporation:

Treasurer—Mr. Riggs, (One year)

Clerk—Calkins (One year)

Trustees: to serve to 1931—H. C. Bumpus, W. C. Curtis, B. M. Dugger, G. T. Moore, W. J. V. Osterhant, J. R. Schaum. W. M. Wheeler, L. L. Woodruff.

M. B. L. Calendar

Wednesday, August 24
8:15 P. M.

Moving Picture and Lecture. "The Tale of an Ancient Mariner". Presented by Chester Scott Howland. Reserved seats, $1.00. General admission, 50c. For the benefit of the Collecting Net Scholarship Fund.

Currents in the Hole

At following hours the current in the hole turns to run from Buzzards Bay to Vineyard Sound:

DATE	A. M.	P. M.
Aug. 13	5:01	5:14
Aug. 14	5:55	6:08
Aug. 15	6:41	6:49
Aug. 16	7:25	7:57
Aug. 17	8:12	8:46
Aug. 18	9:06	9:41
Aug. 19	10:01	10:47
Aug. 20	10:54	11:45

In each case the current changes six hours later and runs from the Sound to the Bay.

ANNUAL WATER SPORTS PROVIDE ENTERTAINMENT

Swimmers and Divers Compete in Fish Commission Basin

Warbasse Boys Outstanding Stars

The annual Woods Hole Water Sports were held on Friday, August 5, and furnished diversion for a large crowd of Laboratory workers, cottagers and townspeople. Thanks to the generous and sympathetic support of the Bureau of Fisheries authorities it was found possible to hold these events in the basin of the Fish Commission, a place admirably adapted to the accommodation of both contestants and spectators.

As always in the past, the Water Sports were sponsored this year by Mrs. J. P. Warbasse, whose enthusiatic interest and whole hearted assistance makes their success possible. To her, and to Drs. Allen and Bradley, who carried on the important work of judging and announcing, a large vote of thanks is due.

The Warbasse and Bradley families were also outstanding in other directions. Dick Warbasse won the Senior Dive and the Senior Dash and 220-yard Swim. Pete Warbasse finished second in the Senior Dash and, with his brother, competed on the winning Relay Team. Steven Bradley won both the Junior Boys' Swim and Dive, and D. Bradley finished second in the Junior Boys' Swim.

Among the girls, Isabelle Morgan and Hilda Wilson carried off highest honors, the former winning the Junior Girls' Dive and finishing second in the 50-yard and 220-yard Swims, the latter winning the Senior Girls' Dive and both the short and long distance Swims.

In the Mens' Relay Races, a picked Penzance-Naushon team defeated a team of Invertebrate Zoologists, after a see-saw struggle.

(Continued on Page 11)

THE BACTERIOPHAGE

Dr. J. J. Bronfenbrenner
Associate, Rockefeller Institute

Dr. Brenfenbrenner delivered a lecture bearing the above title on the evening of July 19. The author's summary and a review of the paper follow.

The agent responsible for the phenomenon of transmissible lysis of bacteria is, according to d'Herelle, a living colloidal micella about 20 mu mu in diameter, belonging to a group of so-called filtrable viruses. Although representing the simplest possible form of life, this agent (variously named by him: Bacteriophage, Bacteriophagum intestinale, Protobios bacteriophagus) possesses all the essential attributes of higher forms of life. It is particulate. It is capable of assimilating bacteria or their products. It multiplies, and if grown on solid media in the presence of susceptible bacteria, it forms colonies. There exists but one universal bacteriophage, which is capable of adapting itself to changes in environment, including changes in the bacterial substratum. It acts on bacteria by invading them and, multiplying within the invaded cells, causes them to distend and finally burst, liberating the parasites in the solution. It secretes a lytic enzyme which finally disposes of the bacterial debris left after the bursting. If the infection by the bacteriophage is not too severe, a certain number of individual bacteria may recover from the disease, developing a specific active immunity.

While the majority of observations of d'Herelle and his collaborators have been substantiated by numerous investigators, there exists a wide divergence of opinion concerning the interpretation of these observations. In a series of investigations covering several phases of the question the lecturer came to the conclusion that the conception of the living nature of the agent of transmissible lysis is not warranted. Without denying the abstract possibility of the existence of some primitive form of life representing the transition in the evolution from unorganized matter to the

(Continued on Page 3)

Review

Dr. B. M. Dugger
Professor of Plant Physiology and Economic Botany, University Wisconsin

The data presented by Dr. Bronfenbrenner in his lecture on the "bacteriophage" are of particular interest, and there is no need of a review of his discussion as a whole. Instead, I may make a few general comments on the field of work, but not as a specialist in it.

Transmissible lysis of bacteria, now frequently referred to as the d'Herelle phenomenon, is for the moment, and properly, one of the unusually attractive fields of investigation in bacteriology. Observations respecting the general course of events in the lysis of certain bacterial cultures may be duplicated readily by any one familiar with bacteriological technique, but the initiation of experiments that may be of critical value in determining or in approaching a determination of the nature of the agent involve varied technique and a wide acquaintance with physico-chemical methods. The phenomenon is of outstanding importance, without regard to possible interpretations.

It happens that almost from the beginning there have been two chief directions of interpretation. Fortunately, both might seem full of possibilities for research and illuminating informations. For d'Herelle and those who believe with him, here is an agency of disease belonging unmistakably to the lower forms of life, and although apparently of colloidal dimensions, it is quite competent to exhibit many

(Continued on Page 3)

"Reminiscences of the Fish Commission"

DR. EDWIN LINTON
Honorary Research Fellow in Zoology, University of Pennsylvania

II. Early Days
(Continued)

In the years 1898-1900 the laboratory was under the directorship of Dr. H. C. Bumpus. His energy and initiative, and the fertility of his mind in suggesting lines of investigation exercised a strong, directive influence on the work that was carried on in those years. Workers in the laboratory in those years were favored by being brought into the intellectually high potential field of Dr. George H. Parker's personality. I recall vividly the ease with which he then, and in succeeding years, undertook the solution of what seemed to be difficult problems, the simplicity of his point of attack, and the success which attended his researches. The sense of hearing in fishes, their reaction to aerial sound waves, the function of the otolith and of the lateral line, were some of the problems which he solved with the aid of such instruments of precision as a hat pin, a two-by-four plank fastened to an aquarium and the one-pound gun of the revenue cutter *Acushnet*.

For several years prior to 1911, when the results were published, systematic work of a quite comprehensive nature was conducted by Dr. Francis B. Sumner, director of the laboratory for a number of years, assisted by Drs. Raymond C. Osburn, L. C. Cole and Bradley M. Davis, in the making of a general biological survey of the region. Nothing of this sort had been attempted since Professor A. E. Verrill's *Report upon the Invertebrate Animlas of Vineyard Sound and the Adjacent Waters, with an Account of the Physical Characters of the Region*. This report will be found in the Report of the U. S. Fish Commission for 1871-2, pp. 295-778; plates 1-39.

The report of the survey which was made by Dr. Sumner and those associated with him was published in Volume xxxl, Parts I and II, of the Bulletin of the Bureau of Fisheries.

A figure familiar to those who were in any way connected with the Fish Commission Laboratory at Woods Hole, from its beginning to the time of his death in 1919, was Vinal N. Edwards, to whose memory a tablet was placed in the Laboratory Building of the Bureau of Fisheries two years ago. A fitting tribute to the activities of Mr. Edwards is given by Dr. Sumner in the introduction to the Report upon the Biological Survey, Part I, p. 12;

> It was found by us that Mr. Edwards still possessed copious notes relating to the yield of fish traps, fyke nets, seining trips, and tow-net collecting which had never been utilized. . . . . Indeed one of the motives which prompted its compilation was a desire to incorporate in a permanent form the valuable but still unpublished data in the possession of this indefatigable collector and observer.

The artistic eye of Charles R. Knight saw in Vinal an interesting type. He made a sketch of him which he afterwards painted. And this reminds me that Mr. Knight first came to Woods Hole in the summer of 1899. Those who listened to his lecture in the Residence Building of the Fish Commission a year or so ago will remember it, I am sure, as one of the most entertaining and instructive talks that they have ever listened to. In 1899 Mr. Knight had a table in my room in the laboratory where he painted a number of fish, among them at least one shark. One day Dr. Whitman's Japanese artist, Hyashi, was in my room and he and Knight were talking about European animal painters. Hyashi was about to make a six week's visit to Paris, and was getting what information he could about Paris animal painters. A part of that conversation still remains in my memory; perhaps it is because I told it to Dr. Bumpus, shortly after I heard it and he had me tell it, I don't know how many times, during that summer. The name of the artist I am not sure about, but as I recall it, the name was Dupin. Hyashi asked: "Do you know painter name Dupin?" To which Knight made answer: "No, I don't think so. How do you spell it?" Hyashi spelled it. Whereupon Knight exclaimed: "Oh, Dupin, you bet! He's a corker!" Hyashi smiled politely, waited a bit for Knight to answer his question, and then asked: "Is he a gooda painter." He was not interested in corkers, but he was interested in animal painters.

While the work which is carried on in the research laboratories of the Bureau of Fisheries has to do mainly with practical problems relating to the fisheries industry much of it is prosecuted without any immediate utilitarian object in view. As an example of the way in which some practical use may be made of data that was collected with no purpose in mind other than to find out certain facts, I may be permitted to include here a bit of personal experience.

On June 17, 1915 I received a telegram from Dr. H. M. Smith, U. S. Commissioner of Fish and Fisheries, asking me to be in Washington on the 19th for a consultation cencerning parasites in butterfish, in order that I might appear on the following Monday before representatives of the Department of Health of New York City to present arguments against the embargo which had been placed upon the sale of that food fish.

I complied with Dr. Smith's request, and at 9:30 A. M. on the 21st I met, by appointment, representatives of the Department of Health at their office, Center and Walker Streets. Of the officials whom I met on that occasion I remember best S. S. Goldwater, Chairman of Commission of the Department of Health, and Dr. Hermann Betts, Chief of Division of Food Inspection. The Department had condemned some consignments of butterfish on account of worms in the flesh. I soon found that it was not cestode cysts in the flesh which were objected to, but nemtodes, which Dr. Betts assured me were wriggling in enormous numbers in the flesh. I told them that I had been examining butterfish in considerable numbers every year for the last ten years, and that while cestode cysts were often present, and sometimes in considerable numbers, that nematodes did not occur in the butterfish which I had examined on the southern coast of New England. I also stated that immature nematodes were common on the viscera of butterfish, as well as of other food fishes, but that they did not in my experience penetrate the flesh. This information, by the way, could have been secured from the fish dealers of Fulton Market. My testimony was ineffective, Dr. Goldwater, with a frankness of expression from which there was a singular absence of suavity, remarking that I did not know anything about nematode parasites in butterfish, and Dr. Betts vehemently asserting that practically every butterfish brought to the market was wriggling with worms. Seeing that we were not likely to get anywhere, the suggestion was made that some butterfish be sent to us from the market. This was done, and in a short time six butterfish were delivered at the office. Dr. Betts bravely attacked one of them with a butcher knife. He valiantly slashed through the belly of the fish, dragging the viscera, which happened to be carrying a considerable number of immature nematodes, mainly clustered on the pyloric caeca, across the muscle tissue. The doughty doctor hopped about in excietment, fairly shouting: "There, see, see them! I told you the flesh was wriggling with them!" I called his attention to the fact that the worms had been dragged by the knife from the abdominal cavity onto the muscle tissue, and asked him to open the others from the back, without disturbing the viscera. This, rather reluctantly as it seemed to me, he agreed to do. None of the fish thus opened had any nematodes either in or on the flesh.

I left the office of the Commissioner of the Department of Public Health in a fairly good humor, although there passed a few minutes of the interview when I yearned to pitch the Commissioner of Public Health out of the window, throwing in the Chief of Division of Food Inspection for good measure.

After I reached Woods Hole I looked over my records of examinations of butterfish for flesh parasites, and was able to report to the Bureau of Fisheries, and my reports were transmitted to the Department of Health in New York, that out of the some 5000 butterfish which I had examined for flesh parasites in successive years, from 1904 to 1914 inclusive, I had record of but two nematodes found in the flesh, and they belonged to a different species from that represented by the immature forms common on the viscera of the butterfish, and other food fish.

It appears that the trouble was started by some, possibly well-meaning blunderer, who induced housekeepers to buy their fish direct from people who supplied the fish at a rate below that asked at the market. These fish were not dressed by the dealer, and when housekeepers, in preparing these fish for the table, saw veritable worms in them, not being familiar with the ways of nature, and associating worms of any kind with what is usually meant by "wormy meat", naturally raised clamorous complaint. This complaint reached the ears of the Department of Health Officials, who immediately, in their ignorance, took action, which, if it had been persisted in, would have meant the destruction of a great amount of wholesome food, and would have kept from the markets of New York a very considerable proportion of the yield of the fish traps of those parts of our coast which supply the markets of that city.

Dr. H. F. Moore, at that time Deputy U. S. Fish Commissioner, estimated that, during the short time that the embargo against butterfish was in effect at New York, butterfish to the value of at least $30,000 were thrown overboard.

(Continued on Page 11)

LABORATORY MACHINE SHOP

One is apt to take a machine shop rather for granted. To most people the words register grease, heat and noise, assorted sounds from the purr of a fan belt to the sharp scratch of filing. But somehow things at the Marine Biological Laboratory all seem to claim the virtue of origniality. The machine shop at the Laboratory is in some ways like your own front parlor. Probably it is cleaner. The most fastidious person would be willing to acknowledge the neatness of the swept cement floor and the remarkable order among the tools and the sort of "what-nots" that usually have the habit of being in perpetual confusion. One wonders what sort of hocus-pocus does the trick. But probably one might call it the "house wifely attitude" applied to machinery. Yet that is hardly a fair way to describe Mr. Larkin and his helpers, for not only do they keep the shop shipshape, but they have improved it with an initiative that has been augmenting the efficiency of the service rendered to the M. B. L.

The great minds in the Laboratory, from the first floor up to the roof are formulating their theories on the flabby mud puppy or on Nereis the circular swimmer, but there are times when they must come down to earth—or rather to the basement, where Mr. Larkin cheerfully officiates.

Several labor-saving devices have been added to the machine shop. There is for instance the apparatus for cutting glass tubing. The tubing is wrapped in a microne wire which is heated until it becomes red hot and sears the glass to a point of easy breaking. Simple enough, but far more efficient than the usual filing.

Glass is an aristorcratic substance for it commands two more machines to minister to its wants. There is a new savage-looking grinder in the machine shop which can destroy the glaze on a piece of glass within a few moments. Secondly there is an oven, shaped very much like the good old-fashioned Dutch bake ovens. Only this one can heat up to 600° C., and by the time this temperature is reached the glass realizes that resistance is impossible and yields to be molded into one of a thousand possible shapes. Not as picturesque as the way they do it in Venice (especially for the benefit of tourists), but more effective for the up-to-date scientist.

Another innovation which saves time, trouble and expense, is found in the proud, new attachments on the ovygen tanks. They are shiny-faced gauges rimmed with brass, and obviate the necessity of sending tanks all the way to Boston to be filled.

The prize achievement of the machine shop this year is, however, the building of two splendid constant temperature baths. One, made by Mr. Phipps, stands in the machine shop, the other is already in action. These peices of machinery look like crosses between a refrigerator and a swimming pool. A large tank is filled with water in which are immersed two, giant electric light bulbs. The water is kept at a constant temperature automatically by means of a mercurial tube which breaks or establishes the electric contact as the temperature changes in accordance. Although the analogy is far fetched, one is somehow, reminded of the spasmodic electric signs on dear, distant Broadway as the light flashes on beneath the water with surprising suddeness There is, though, a feeling of far greater awe on being informed that the regulatory apparatus is as fussy as to keep the temperature correct to one one-hundredth of a degree. The water is of course kept in constant circulation, and it is said that the machine works better at low temperatures.

To the researchers who use these strange contraptions with as much abandon as you might pick up an ordinary saucepan, the machine shop is just another room in the brick building, but to those credulous and uninitiated ones who can still marvel at machinery, it has a faint stir of magic about it.

Bronfenbrenner's Summary

(Continued from Page 1)

organized, the lecturer believes that bacteriophage does not exemplify such a transition.

The experimental evidence presented by the lecturer tends to indicate that the agent of transmissible lysis of bacteria is diffusible. The particulate distribution of the agent is therefore only apparent and is due to its ready adsorption on the surface of colloidal particles of the medium. The size of the particles which are apparently endowed with the activity is not uniform; moreover, it can be varied experimentally by causing redistribution of the agent on the surface of more highly dispersed colloids.

The agent has no independent metabolism. it does not respire and does not possess reducing power. While it undoubtedly accumulates in the medium during the reaction there is no evidence of actual growth and assimilation of the substratum by it. It accumulates only in the presence of actively growing young susceptible bacteria, and the rate of its accumulation depends entirely on the rate of growth of the susceptible bacteria.

The sterile areas produced by the agent on the surface of agar seeded with bacteria do not represent "colonies" of the living virus but are the result of diffusion of the lytic agent. The size and number of the sterile areas (plaques) can be varied at will by changing the concentration of the medium. At low temperatures diffusion of the agent continues, and the size of the plaques increases in spite of the inhibition of bacterial growth and the consequent interruption in the further production of bacteriophage.

The adaptibility of the agent to various bacterial substrata is strictly limited within the group of closely related species, and is not a general rule even within these limits. The samples of bacteriophage affecting unrelated species of bacteria exhibit a number of characteristics which make it possible to distinguish them from one another. When a given material exhibits activity for two or more species of unrelated bacteria it can be shown that it contains a mixture of different phages.

The agent is probably a product of bacteria secreted by them into the medium during the abnormally rapid growth stimulated by the small amount of phage introduced from without. Apparently, similar changes in bacteria may be set up within the animal organism by some as yet unknown stimulus, and may result in the spontaneous production of phage. Although many investigators claim to have caused such spontaneous production of phage by bacteria under the influence of various stimuli, in vitro, their evidence is not quite convincing.

When active agent (phage) is introduced into a bacterial culture, it begins to accumulate there prior to and independently of the lysis of bacteria. Within a few hours following its introduction, bacteria begin to swell. Measurements of the viscosity of the culture indicate that at the height of the reaction bacterial mass may occupy twelve or more times its original volume. Cinematographic record shows that at the height of swelling bacteria burst, without leaving any visible debris in the majority of instances. Ready solubility of the bacterial residue would indicate that the cytoplasm has undergone digestion prior to bursting of the bacteria. Chemical analysis of lysed cultures shows evidences of such digestion.

Duggar's Review

(Continued from Page 1)

of the activities of living organisms. With this interpretation we would be in possession of material for experimental work within the realm of the animate but on the very borderland of the inanimate. It would be a surprising opportunity, and the parasitism—if such it is—of this agency on the bacteria renders it not much more difficult of experimentation than if it were a saprophyte.

On the other hand there has been the other general line of interpretation, none too definitely formulated in most cases, to the effect that this specific lysis, or any similar lysis, does not involve the idea of parasitism. In general, the lytic agent is regarded as of enzymic nature; at least, the process must be directly chemical, perhaps a chain of reactions, with appropriate catalyzers.

This view naturally leads (in part) to an intensified study of organic catalysts in general and of the possible effects of chemical agents in activating the production of the complex catalysts characteristic of the cell.

In short, the borderland of the animate would be fascinating; but the "propagation" of a pathological metabolic disturbance, whether as a "disease" of a colony of bacteria or of a multicellular tissue or organism would be no less stimulating of research. The possible relation of bacteriophage studies to certain, at least, of the so-called virus diseases of animals and plants is obvious.

Dr. Bronfenbrenner's work is a positive contribution, and among other conclusions deducible from it is this: Certain of the assumptions of d'Herelle are not substantiated, and some exact experimental evidence is afforded to challenge the view that "Bacteriophage" is an organism.

Dr. Stephen Walter Ranson, M. D., Ph. D.,—the author of "The Anatomy of the Nervous System"—is now Professor of Neuro-Anatomy at Washington University in St. Louis. His position was incorrectly given in the advertisement of W. B. Saunders Company in our last issue owing to the accidental omission of the proof corrections made by the publisher.

Conservation Work of Bureau of Fisheries

(Continued from Last Issue)

In a somewhat similar manner the cod of the Atlantic Coast are being investigated. We are learning many important things about their life-history and their migrations. From 1923 to 1926, over 36,000 cod, haddock and pollock were tagged off the coast of New England. Approximately 1600 of these were recaptured. There can be no question that the data obtained will be of incalculable value if the time ever comes when it will be necessary to protect these fisheries. Fortunately there is no evidence at the present time that depletion is taking place, but the great fishing banks are being exploited more and more each year, not only by the fishermen of the United States and Canada but also by European fishermen.

Division of Fish Culture

Very early in its history the bureau undertook the propagation and distribution of the more important food and game fishes. The heaviest mortality among fishes occurs during their early life. Just as there is a greater death rate among babies than among older people so there is a greater death rate among young fishes during the first few days or months of their lives. Artificial propagation is designed to eliminate the hazards of life in the early stages of fish development.

From a small beginning this service has now come to be one of the largest in the Bureau and annually millions of young fish are reared and distributed in the interior and coastal waters of the United States. During the years 1925 and 1926 the annual distribution of fish of all species and stages of development totaled approximately 5,232,000,000 and of these all but about 108,000,000 were of direct commercial importance. In the production of this enormous number of young fish the Bureau operated 70 separate fish cultural stations. An important phase of this work has been the cooperation between the bureau and the various States which have thus far taken an active interest in practical fish culture. Such cooperative work has been varied in its nature, involving in some instances joint operations at egg-collecting stations, and frequent exchange of eggs of various species for the convenient distribution of the resulting fish. In other cases the bureau has loaned its distribution cars to enable the States to quickly and economically distribute the fish from their hatcheries. In still other cases the bureau has been able to incubate fish eggs in its hatcheries acquired by States not operating hatcheries, the resulting fry or fingerlings being placed at the disposal of the State officers. Further cooperative work has been carried on in conjunction with clubs and individuals who have established nurseries for rearing to larger size fish furnished by the bureau. The net result has been to increase the fingerlings production for 1926 two fold over that for 1925.

In addition to the work of propagation, this division has developed methods of rescuing fish from the pools left by receding river waters following spring floods. This work is conducted mainly in the upper Mississippi Valley and about 150,000,000 fish are rescued each year from pools where they would undoubtedly die and are returned to the main river. This is one of the most important and popular features of the bureau's work in fish conservation. During the year 1922 this work attained its greatest volume in the number of fish handled. A total of nearly 180,000,000 fish was thus salvaged and either returned to the original waters or delivered to applicants for planting in adjacent territory. The salvaged fishes comprise practically every useful species common in this region. There is considerable fluctuation in the volume of this work, which depends upon climatic conditions and the stage of the river.

The division of fish culture and the division of scientific inquiry have cooperated for a number of years in the development and conservation of the fresh-water mussels of the Mississippi Valley. The shells of these mussels form the raw material which is used in the manufacture of pearl buttons—an industry of considerable importance producing an annual output of about $7,000,000. The young mussels during the first two or three weeks of their lives are minute microscopic animals. During this stage of their existence they live on the gills of certain fishes. It is necessary that they find the proper host fish soon after they are released from the parent or else they perish. The young mussels do practically no harm to the fish on which they are living and the Bureau has aided the maintenance of the supply of mussels by bringing the young mussels and the proper host fishes together. This work is done mainly in connection with the rescue operations. At the time the fish are taken from the pools and before they are returned to the river some are placed in a tank of water in which enormous numbers of the minute larval forms of the mussels have been liberated. In a very few minutes hundreds of these have attached themselves to the fish which are then released. In two or three weeks the larval mussels will free themselves from the host and will drop into the mud at the bottom of the rivers and smaller streams where they may develop into adult mussels of commercial size.

Division of Fishery Industries

The activities of this division are directed along several lines; the gathering and study of fishery statistics, collecting data on the methods of the fisheries, and technological work looking toward the improvement of methods of preparation and merchandising of the fishery products and of the use of their by-products.

The importance of adequate fishery statistics in a program of conservation can not be overestimated. It is only by the collection and study of such statistics that the diminution in the stock of fish may be detected before it has progressed to such an extent that it is apparent to fishermen. In that event it has already proceeded to such a degree that a rehabilitation of the stock is very difficult, if not impossible. The division of fishery industries attempts to collect as complete statistics as is possible with its limited personnel and funds. In order to canvass the fisheries of the United States, it has been necessary to divide the country into a number of sections which are canvassed at intervals of five or more years. The sections are as follows: The New England states, the Middle Atlantic states, the South Atlantic states, the Gulf states, the Pacific states, the Great Lakes and the Mississippi River and tributaries.

It is recognized that statistics collected at such intervals are really not adequate for conservation purposes. In view of this fact, special systems of statistics have been instituted for some of the more important fisheries, especially those of international character. These consist of statistics which are published monthly of vessel landings at the principal New England ports, and at Seattle, Washington, and also annual canvasses of the shad fisheries in the Hudson and Potomac Rivers. The statistics in all cases include information on the number of men engaged and the gear employed in order that the intensity of the fishing effort may be evaluated. Such data are of great value and provide the only source of information which we have of the present tendency of our fisheries. They form the foundation on which must be based the practical application of measures for conservation.

Supplementing these statistics on landings of fish there is an annual report on the production of canned fishery products and by-products, and a monthly publication of the amounts of fish frozen and held in cold storage. The latter are collected by the Department of Agriculture through its Bureau of Agricultural Economics. These serve to furnish information of value in following the development of these two very important phases of the fishing industries.

The extent to which fishery products may be made available to the people of the country is determined to no small extent by the price paid by the ultimate consumer. This price is determined in part by the cost of fishing operations and this in turn is determined in part by the cost of gear. Within the past few years the division of fishery industries has conducted extensive investigations looking toward the improvement of net preservatives. It has developed a method of prolonging the life of fish nets by means of a copper compound which has found considerable favor, and is being used rather extensively. Further experiments are being conducted along these lines.

Studies of the basic principles involved in the preservation of fish with salt have made possible the successful salting of fish at higher temperatures and therefore in warmer climates. Such methods are now in commercial practice. Improved methods for freezing fish for storage and transportation have been worked out. Such improvements will tend to reduce the losses during shipment, which are wasteful of a valuable food product and which are an important factor in increasing the cost of fish to the consumer. Improved methods have been developed for the canning of sardines which, it is believed, will make for a better product; possibly produced at a lower price, and which will tend to reduce the waste of this valuable fish.

These examples are illustrative of the technological work of this division. The importance of this work from the viewpoint of conservation lies in the fact that the development of better methods of handling fishery products will prevent unnecessary waste and will improve the product and at the

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One Hundred Dollars For Scholarship Fund

James Harvey Robinson Makes Contribution

The Collecting Net Scholarship Fund has received a most welcome donation in the form of a one-hudred-dollar check from Mr. Robinson. In making the gift he said that their were no strings attached to it and that his donation was made as a token of appreciation to the laboratory.

The Scholarship Fund has now accumulated the sum of $155.00, for the contributions listed below have been received:

Dr. James Harvey Robinson	$100.00
Mrrs. Annie Nathan Meyer	10.00
Dr. Ralph Cole	10.00
Anonymous	25.00
Anonymous	10.00
Total	$155.00

The Committee on Awards met at noon on Thursday and selected fifteen possible candidates for the two available scholarships. An application blank has been mailed to each of the candidates, and upon their return a careful study will be made by the committee which is made up by those in charge of each of the five classes.

INSTRUCTIONS IN NAVIGATION

The following directions have been taken from the government been taken from the Government Tide Book:

Woods Hole is a narrow passage leading between numerous ledges and shoals from Vineyard Sound to Buzzards Bay, between the mainland and Nonamesset Island. It is well marked by buoys and beacons, but the tidal currents are so strong that the passage is dangerous without some local knowledge. The buoys in the narrowest part of the channel are frequently towed under by the currents. A stranger should not attempt to pass through except near slack water. Woods Hole is little used as an anchorage on account of the strong tidal currents and the narrow channel. Great and Little Harbors are on the northern side.

The northerly channel in Woods Hole from Great Harbor to Buzzards Bay has a narrow but straight reach and was dredged 300 feet wide and 13 feet deep, but there are numerous spots with 10 to 12 feet over them. Another channel, *Broadway*, was dredged 300 feet wide and 11 feet deep, but it necessitates a sharp turn; the straight reach should be given the preference on account of the difficulty in making the turn in the strong currents. The deepest draft using the passage are local steamers of 11 feet draft.

Nobska Point, on the eastern side of the approach to Woods Hole, is a low bluff marked by a lighthouse (white tower with covered way to a dwelling). Storm warning displays are made near the lighthouse. Ledges, partly bare at low water, extend 150 yards southwestward from the point.

Little Harbor is the easternmost of the two coves in the north shore of the passage. A channel 150 feet wide and 12 feet deep has been dredged to the wharf of the lighthouse depot, which is on the western side of the cove. and a turning basin 400 feet wide and 10 to 12 feet deep in front of the wharf. Small craft can anchor off or above the wharf, favoring the western side, in 7 to 12 feet. The dredged channel is marked by buoys, the course is marked harbor through it is 351° true (N ½ E mag.).

Great Ledge is an extensive rocky shoal, awash at extreme low water, between the entrances to Little and Great Harbors. A red gas buoy marks its southwest side.

Nonamesset Shoal is partly bare at low water, has depths of 10 to 13 feet near its edge, and extends 400 to 500 yards eastward from the island on the western side of the entrance to Great Harbor. The shoal is marked at its southeasterly end by a black bell buoy, and on its easterly side by a black buoy.

Great Harbor has an anchorage at the head about ¼ mile long and nearly ¼ mile wide; its depth is irregular, ranging from 3½ to 12 fathoms in the channel, and the holding ground is mostly poor. On the eastern side of the harbor is the wharf and depot of the New York, New Haven & Hartford Railroad; and above this is the wharf, basin and large buildings of the United States Fish Commission, which are prominent when entering from southward. Shoals with 5 to 9 feet over them extend 400 yards from the northwesterly end of the harbor. There is good anchorage 200 yards northwestward of the current and time of slack water are affected by strong winds. At either entrance to Woods Hole the velocity of the current at strength is nearly 1 knot.

In the upper part of Great Harbor, near the Fish Commission wharf, the currents are barely perceptible and vessels at anchor lie head to the wind.

Ice.—The strong tidal currents usually keep Great Harbor open. Drift ice is brought through from Buzzards Bay, but seldom interferes with navigation, except in unusually

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The Collecting Net

A weekly publication devoted to the activities of the Marine Biological Laboratory and of Woods Hole in general.

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The Universal Press
New Bedford Woods Hole
Massachusetts

The Woods Hole Choral Society

The Woods Hole Choral Society won for itself many friends on Monday evening when it presented its first annual concert. There are, however, a limited number of individuals at the laboratory who feel that its organization is not warranted. To us it seems a commendable undertaking. As Dr. Linton so well says: "there are a goodly number of people in the community who derive a great deal of pleasure from choral singing, and who are willing to devote a part of the time which they would, and should, give to recreation to the practice of choral singing." The rehearsals of the Choral Society are held twice a week after the conclusion of the evening lecture and thus they conflict in no way with laboratory work.

We shall go a step further than the modesty of Dr. Linton —who is president of the society—permitted sufficient excuse and reason for the existence of this society is alone furnished by the real enjoyment and pleasure that it will give to others. Those who attended Monday's concert will vouch for this statement.

Dr. Arata Terao arrived on August 10 to carry on work as an independent investigator. Dr. Terao is professor of Zoology at the Imperial Fisheries Institute in Tokyo, Japan.

Ode to Drosophila

(*Tune:—"Maryland, my Maryland."*)

Drosophila, Drosophila, enshrined within thy lactic jar,
What variations there are seen—red, barred, balloon, and eosin;
What strange proportions in they race,
When non-disjunction takes its place;
Yet from them many a formula we learn to know, Drosophila.

Drosophila, Drosophila, thou dipterous philosopher,
Within thy macrohromosomes, how many pangenes have their homes?
Thy spermic cells, O muscid elf,
Teach me the secrets of myself,
And Life's deep problems buried are, within thy cells. Drosophila.

* * *

Turpentine

(*Tune: "Clementine."*)

In a pine-tree, in the barrens, overgrown with poison-vine,
Grows a substance soft and gummy, and its name is Turpentine.

Chorus: Oh, my sticky, oh, my gummy,
Oh, my oily Turpentine;
I will put you in my bottle,
Then I know that you'll be mine.

In the ages called Cretaceous, dripping from the bark of pine
Catching gnats, bugs, and mosquitoes, grew some sticky Turpentine.

Chorus:

Buried up for countless ages in the sea and mud and slime,
Then washed up upon the seashore comes our fossil Turpentine.

Chorus: Oh, my solid, oh, my golden,
Oh, my amber Turpentine.
Put you in my lady's necklace,
Then you'll be both hers and mine.

* * *

Invertebrates

Invertebrates are everywhere—fresh water, land, and sea;
You even find them in the air in great variety.

Chorus: There is rest—there is rest—
Poor invertebrates, they soon will rest—
Sweet rest!

The lightning-bug is a funny bug; he doesn't know his mind;
He flies about this world of ours with his headlight on behind.

Chorus:

Oh, Hydra is a greedy beast—of that there is no question;
He will eat ten times his weight at least, and he won't get indigestion.

Chorus:

Mosquitoes haven't any sense, as far as I can see—
They pass the nice fat people by and stick their beaks in me.

Chorus:

The rotifer he lives alone, but oh, what fame is his,
As an unsuspecting case of phylopaedogenesis.

Chorus:

The butterfly has wings of gold, the firefly wings of flame;
The bedbug has no wings at all, but he gets there just the same.

Chorus:

The tapeworm shuns the outside world; he's free from care and strife;
He knows the advantageousness of parasitic life.

Chorus:

His food is predigested, stored outside his body-wall;
That's fortunate, for he has no digestive tract at all.

Chorus:

I always thought that fleas were black, but now I do not know—
For Mary had a little lamb whose fleece was white as snow.

Chorus:

The centipede must hate to walk, for when he moves around
He has to lift a hundred feet and place them on the ground.

Chorus:

DR. FISH TELLS OF KARTABO LABORATORY IN BRITISH GUIANA

Last Wednesday in the Auditorium, Dr. H. D. Fish introduced some of us and "revisited" with others the magic realms of British Guiana. His preliminary apologies for the repetition of his subject and its lack of serious, scientific savour were hardly necessary, for most of us were glad to sit quietly and travel through sunlit seas and impassible jungles without the conventional accompaniment of graphs, figures and statistics. The slides were beautiful and often amusing, as in the case of the "Mona Lisa" sloth. Dr. Fish succeeded in making his South American field appear a place of interest and promise. Here is the land of virgin forest growths, where there are approximately 3000 species of trees, only three hundred of which have been identified. Here insect life takes beautiful and fantastic forms which are myriad in number, here the native women are ancient and withered at the age of forty-five, here bamboo grows at an average of eleven inches a day. Here, also, the sun seems ever to set in a mist of glory while the moon sails through cloud seas over sapphire waves.

Dr. Fish, after stressing the unlimited possibilities for research in this virgin field of British Guiana, made a rather impassioned plea for the interest of the audience in his project of sending students here to carry on and increase the researches now going on, and seemed confident of being able to secure the financial cooperation of commercial organizations interested in developing the resources and limiting the drawbacks of life in the tropics.

It sounded very tempting. We thought that we would like to see the armadillo, "dillowing in its armor", the traveller's palm that always points north-south, the falls whose rebound is greater than the entire height of Niagara, and the sun setting over the Kartabo Laboratory. But when we thought of the darky who floated his raft upstream when the tide ran up and anchored when it ran down, and so proceeded upstream "all in the course of nature", we wondered how much research we would accomplish beneath the tropic sun. And the thought of a mess serving monkey meat cooled our ardor. However, we agree with Dr. Fish that anyone anxious to go and tackle the innumerable problems which await the scientist in this corner of the earth, should receive all the assistance that can be obtained.

WEATHER SIGNS

The following notes concerning weather prediction are gleaned from Eldriges *Tide and Pilot Book*:

Whether clear or cloudy, a rosy sky at sunset presages fine weather; and a red sky in the morning, bad weather, or much wind, perhaps rain; a grey sky in the morning, fine weather; high dawn, wind; low dawn, fair weather.

A high dawn is when the first indications of daylight are seen above a bank of clouds. A low dawn is when the day breaks on or near the horizon, the first streaks of light being very low down.

Soft-looking or delicate clouds foretell fine weather, with moderate or light breezes; hard-edged, oily-looking clouds, wind. A dark, gloomy, blue sky is windy; but a light, bright-blue sky indicates fine weather. Generally, the *softer* the clouds look, the less wind (but perhaps more rain) may be expected; and the harder, more "greasy," rolled, tufted, or ragged, the stronger the coming wind will prove. Also, a bright yellow sky at sunset presages wind; a pale yellow, wet; and thus by the prevalence of red, yellow, or grey tints, the coming weather may be foretold very nearly—indeed, if aided by instruments, almost exactly.

Small inky-looking clouds foretell rain; light scud clouds driving across heavy masses show wind and rain; but if alone may indicate wind only.

High upper clouds crossing the sun, moon, or stars in a direction different from that of the lower clouds, or the wind then felt below, foretell a change of wind.

After fine, clear weather, the first signs in the sky of a coming change are usually light streaks, curls, wisps, or mottled patches of white distant clouds, which increase, and are followed by an overcasting of murky vapour that grows into cloudiness. This appearance, more or less oily, or watery, as wind or rain will prevail is an infallible sign.

Light, delicate, quiet tints or colors with soft, undefined forms of clouds, indicate and accompany fine weather; but gaudy or unusual hues, with hard, definitely outlined clouds, foretell rain, and probably strong wind.

When seabirds fly out early and far to seaward, moderate wind and fair weather may be expected. When they hang about the land, or over it, sometimes flying inward, expect a strong wind, with stormy weather. As many creatures beside birds are affected by the approach of rain or wind, such indications should not be slighted by an observer who wishes to foresee weather.

Remarkable clearness of atmosphere near the horizon, distant objects, such as hills, unusually visible, or raised (by refraction), and what is called "a good *hearing* day," may be mentioned among signs of wet, if not wind, to be expected.

More than usual twinkling of the stars, indistinctness or apparent multiplication of the moon's horns, haloes, "wind-dogs" (fragments or pieces of rainbows, sometimes called "wind-galls") seen on detached clouds, and the rainbow, are more or less significant of increasing wind, if not approaching rain, with or without wind.

Lastly, the dryness or dampness of the air, and its temperature (for the season) should *always* be considered *with other* indications of change, or continuance of wind and weather.

BY THE MOONLIGHT

The nereis, the nereis
By moonlight grows delirious:
He fills the sea .
With progeny,
Now isn't that mysterious?

Olga Marx.

THREE-IN-ONE

Michondria and chomosomes,
Round vacuoles and nuclei,
Upon their propoplasmic sea
In solemn state go floating by
In this dam cell.

A dash of Houbigant's Ideal,
A flashing and coquettish eye,
Fair cheeks, rouged lips, and powdered nose,
All pass in frou-frou quickly by
In this damsel.

Now that I've found I've flunked the course,
And that girl will homeward fly,
I rail at fate; filled with remorse
I cuss, I growl, I pine, I sigh—
They're both dam sells.

pH. D.

The Kny-Sheerer Corporation has recently moved to larger and much more conveniently situated quarters in New York City. Their address is now: 10-14 West 25th Street, New York, N. Y.

At the end of last month Dr. Edwin G. Conklin took a short lecture trip. At Columbia University he delivered two lectures: (1) "Heredity versus environment in human progress" and (2) "Some common misconceptions regarding evolution." Before returning to Woods Hole Dr. Conklin was a guest of the Mount Desert Biological Laboratory where he gave a talk on the evolution controversy in the United States.

Conservation Work of Bureau of Fisheries

(Continued from Page 4)

same time tend to lower the price. If the true conservation of our fisheries includes their full utilization, these are matters of no little importance. They do not tend, under ordinary circumstances, to reduce the strain on a fishery resource but they do make possible a fuller utilization of those fishery products available.

Alaska Service

The administration of the fisheries in the United States is vested for the most part in the several states, but the fisheries of Alaska are under the direct supervision of the federal government. While these fisheries have been made the subject of Congressional legislation from time to time over a period of many years, it was not until 1924 that legislation designed to meet fully the requirements was enacted. The Act of Congress approved June 6, 1924, provided comprehensive legislation for the regulation and conservation of the fisheries of Alaska and broadened very greatly the authority of the Secretary of Commerce to promulgate regulations to meet local and changing conditions. This legislation has brought about the control of the fisheries along scientific and economic lines and the beneficial results are clearly apparent. The laws and regulations are enforced by members of the bureau's Alaska personnel which in the active fishing seasons is augmented by a considerable force of temporary employees. A fleet of patrol vessels is maintained and other vessels are chartered when necessary for patrol work.

The fur seals in which the United States is directly interested make their home during the summer on the Pribilof Islands, Bering Sea, Alaska. Here the young are born and cared for until they are strong enough to take to the ocean and travel with their parents on the long winter migration to the southward. Although a few other small herds of fur seals exist both in the North Pacific and in the Antarctic it is probable that the Pribilof Islands herd comprises nearly 90 per cent of all the fur seals in the world. This herd came under the control of the United States at the time Alaska was purchased from Russia in 1867. From 1870 to 1910 the right to take seals on these islands was leased by the Government to private corporations. In 1910, however, the Government assumed entire control of operations at the islands and since that time the administration of this interesting and valuable resource has been in the hands of the Bureau of Fisheries.

A most serious evil threatening the sealing industry some years ago was pelagic sealing. This means the killing of seals while they are in the water. It is destructive alike of males and females. It is economically wasteful in that a large proportion of the seals killed are not secured and the skins are accordingly lost. After the young are born and while they are still on the islands nourished by their mother's milk, each mother seal killed while at sea for food, means the loss of another seal, its pup, which is left on the islands to starve. In 1911 a convention was entered into between the United States, Great Britain, Japan and Russia which prohibited this wasteful and cruel practice. Through the effective patrol maintained by the United States Coast Guard supplemented in southeastern Alaska by patrol vessels of the Alaska service, the Pribilof Islands fur seals are fully protected at sea. The killing of seals on the islands is carried on under the careful supervision of the Bureau's experts. Only the young males are killed. Of these there is always an excess, since the fur seal is highly polygamous, so that the herd is free to increase at its normal rate of growth. Computation of the number of seals is made each year while they are at the islands and the beneficial results of this care is shown by the fact that the seal population has increased from about 132,000 in 1910 to 761,000 in 1926.

Additional information on the activities of the Bureau of Fisheries may be obtained from the Annual Reports of the Commissioner of Fisheries or from the Annual Reports of the various divisions and of the Alaska service.

Dr. Rudolf Bennitt, formerly instructor in biology at Tufts College has been appointed associate professor of zoology at the University of Missouri next fall. Dr. Leonard P. Sayles from Norwich University will replace Dr. Bennit at Tufts College.

THE ARISTOCRAT

The stiffest thing in all the Lab.—
Humans apart—is the Horse-shoe Crab.
His aristocratic pretensions are right,
For he traces his line to a Trilobite
Who swam in the Mezozoic Seas
So kow-tow to the Horse-shoe Crab, if you please.
And his blood is blue; so scientists say
He was rich in copper, and got that way.

pH. D.

WHALING INDUSTRY WILL BE SUBJECT OF LECTURE AND MOVIE

For those whose imaginations are stirred by brave tales of the sea and the men who follow it, a treat has been prepared by *The Collecting Net.* Mr. Chester Scott Howland, lecturer and the son of an old New Bedford whaling captain, will give a lecture illustrated by moving pictures of his own making. The theme is of those "ancient mariners" of New Bedford and Nantucket whose vessels sailed the seven seas in search of fortune, the "praying deacons" who left their Cape Cod plowshares at the age of fourteen to answer the call of the sea, of the women who worked and waited sometimes as long as seven years for their ships to come in, of rigging and harpoons, the toll of the sea, and the lore of whalers and whaling ways. The pictures are extremely interesting and show the methods of whaling before the romance of the windjammer gave way to the progress of steel, and the whale-oil lamp to the incandescent bulb. Besides the reels there will be slides made from old pictures of whaling methods, and extracts from the logs of old whaling vessels. The lecture will be given at 8:15. There will be an admission fee of fifty cents for non-reserved seats and a dollar for reserved seats, the proceeds of the performance to be added to the Scholarship Fund.

FITZROY'S BAROMETER INSTRUCTIONS

The following notes on foretelling the weather with a Fitzroy Barometer appeared in Eldridge's Tide and Pilot Book:

The words on scales of barometers should not be so much regarded for weather indications as the *rising* or *falling* of the mercury; for it is stand at *changeable* (29.50), and then rise towards *fair* (30.00), it presages a change of wind or weather, though not so great as if the mercury had risen higher; and, on the contrary, if the mercury stand above *fair* and then fall, it presages a change, though not to so great a degree as if it had stood lower: beside which, the direction and force of wind are not in any way noticed.

It is not from the point at which the mercury may stand that we are alone to form a judgment of the state of the weather, but from its *rising* or *falling* and from the movements of immediately *preceding* days as well as hours, keeping in mind effects of change of *direction*, and dryness, or moisture, as well as alteration of force or strength of wind.

It should always be remembered that the state of the air *foretells coming* weather, rather than shows the weather thas is *present*—(an invaluable fact too often overlooked)—that the longer the time between the signs and the change foretold by them, the longer such altered weather will last; and, on the contrary, the less the time between a warning and a change, the shorter will be the continuance of such foretold weather.

If the barometer has been about its ordinary height, say near thirty inches at the sea-level, and is steady on rising, while the thermometer falls, and dampness becomes less—north-westerly, northerly, or north easterly wind, or less wind, less rain or snow may be expected.

On the contrary, if a fall takes place with a rising thermometer and increased dampness, wind and rain may be expected from the south-eastward, southward, or south-westward.

A fall with low thermometer foretells snow.

When the barometer is rather below its ordinary height, say down to near twenty-nine inches and a half (at sea-level), a rise foretells less wind, or a change in its direction towards the northward—or less wet: but when it has been very low, about twenty-nine inches, the first rising usually precedes or indicates strong wind—at times heavy squalls—from the north-westward, northward or north-eastward; *after* which violence a gradually rising glass fortells improving weather, if the thermometer falls; but if the warmth continue, probably the wind will back (shift against the sun's course), and more southerly or south-westerly wind will follow, especially if the barometer is sudden.

The most dangerous shifts of wind, or the *heaviest* northerly gales, happen *soon* after the barometer *first* rises from a very low point; or, if the wind veers *gradually*, at some time afterwards.

Indications of approaching change of weather, and the directions and force of winds, are shown less by the height of the barometer than by its falling or rising. Nevertheless, a height of more than thirty (30.0) inches (at the level of the sea) is indicative of fine weather and *moderate* winds, except from east to north *occasionally*.

A rapid rise of the barometer indicates unsettled weather; a slow movement the contrary; as, likewise, a *steady* barometer, which, when continued, and with dryness, foretells very fine weather.

A rapid and considerable fall is a sign of stormy weather, and rain or snow. Alternate rising and sinking indicates unsettled and threatening weather.

The greatest depressions of the barometer are with gales from S. E., S. or S. W., the greatest elevations with wind from N. W., N. or N. E., or with calm.

A sudden fall of the barometer, with a westerly wind, is sometimes followed by a violent storm from N. W., or N. or N. E.

If a gale sets in from the E. or S. E. and the wind veers by the South, the barometer will continue falling until the wind is near a marked change, when a lull *may* occur; after which the gale will soon be renewed perhaps suddenly and violently, and the veering of the wind towards the N. W., N. or N. E., will be indicated by a rising of the barometer, with a fall of the thermometer.

After very warm and calm weather a storm or squall, with rain, may follow; likewise at any time when the atmosphere is *heated* much above the *usual* temperature of the season.

To know the state of the air: not only the barometer and *thermometer*, but appearance of the sky should be vigilantly watched.

Instructions in Navigation

(Continued on Page 5)

severe winters, when it may close the entrance from that bay.

The following directions are good for vessels of 10 feet draft with slack water in Woods Hole:

Approaching from eastward, pass about 1/4 mile southward of Nobska Point and Coffin Rock buoy on a west-southwesterly course; or, from Nobska Point gas and bell buoys, steer 279° true (WNW mag.) until on the Great Harbor range. From westward give the south side of the Elizabeth Islands a berth of about 1/2 mile, and steer for Nobska Point lighthouse on any bearing northward of 51° true (NE by E 3/4 E mag.) until about 3/4 mile from it and on the Great Harbor range.

Steer 345° true (N mag.) on the Great Harbor range (two lights on the Fish Commission wharf), and pass about 150 yards eastward of Nonamesset Shoal bell buoy, about 50 yards westward of the red gas buoy marking Great Ledge, and about 50 yards eastward of the black buoy off the eastern side of Nonamesset Shoal.

When nearly up with Parker Flats buoy, a red buoy and a black buoy will be seen close westward, the red buoy lying just southward of Grassy Island Ledge light (a spindle with lantern). Turn sharply westward, pass midway between these buoys on a 257° true (W 1/8 N mag.) course, and pass about 200 feet northward of a black can buoy and about 100 feet northward of a black spar buoy (lying close northward of Middle Ledge light). When past the latter buoy bring Middle Ledge light astern on a 284° true (NW by W 1/2 W mag.) course, heading for the north end of Uncatena Island, until the red buoy off Long Neck is about 100 yards distant and in range with the western side of Long Neck, bearing 14° true (NNE by W 1/2 mag.). Then steer 330° true (N by W 3/8 W mag.), which will lead into Buzzards Bay about 250 yards eastward of the black bell buoy off Naushon Point Shoal.

Vessels of 7 feet or less draft can pass 300 yards southwestward of Nobska Point and steer 290° true (NW by W mag.) so as to pass about 200 yards southward of Juniper Point, leaving Coffin Rock buoy well to the southward and the red buoy off Juniper Point about 100 yards to the eastward. Then steer 333° true (N by W 1/8 W mag.) for the end of the Fish Commission wharf until nearly up to Parker Flats buoy, and if going through into Buzzards Bay, follow the directions in the preceding paragraph.

ANNUAL WATER SPORTS PROVIDE ENTERTAINMENT

(Continued from Page 1)

A complete summary of the events follows:

Boys' Race: under 12 years—Winner: Stephen Bradley; Second: Simon Wilson.

Girls' Race: under 12 years—Winner: Doris Draper; Second: Jane Rogers.

Junior Boys' Dive—Winner: S. Bradley; Second: D. Bradley.

Junior Girls' Dive—Winner: Isabelle Morgan; Second: Ruth Rogers.

Boys' Race: under 16—Winner: Fairfield Dana; Second: Bernard Holman.

Girls' Race: under 16—Winner: Alice Jigger, Second: Isabelle Morgan.

Boys' Tub Race—Winner: John Faggi; Second: George Duggar.

Girls' Tub Race—Winner: Doris Draper; Second: Betty Cool .

Senior Boys' Race (50 yards)—Winner: Dick Warbasse; Second: Pete Warbasse. Time: 26 seconds.

Senior Girls' Race (50 yards)—Winner: Hilda Wilson; Second; Dorothy Dana. Time: 27 seconds.

Senior Boys' Dive—Winner: Dick Warbasse; Second: H. Field and C. Bradley tied.

Senior Girls' Dive—Winner: Hilda Wilson; Second: Dorothy Dana.

Boys' Race (220 yards) Winner: Dick Warbasse; Second: Bob Stabler.

Girls' Race (220 yards) Winner: Hilda Wilson; Second: Isabelle Morgan.

Mens' Relay Race—Penzance-Naushon (P. Warbasse, Russell, Allen, D. Warbasse) defeated Invertebrates (Lovell, Abell, Pickett, Stabler.)

Reminiscences of the Fish Commission

(Continued from Page 2)

In July of the following year there was another flurry in the Department of Health arising from complaint of wormy butterfish, I was sent again to interview the authorities. This interview took place on July 5, 1916. I found a very different set of men in charge from those whom I had encountered the previous year. My interview was with Mr. Lucius Polk Brown, Head of the Department of Food and Drugs. He was of such a different type from that which I had associated with New York Health officials, that, after the very satisfactory interview was concluded, I asked him what part of the country he came from. He said that he was a Tenesseean. The memory of this genail and sensible soul offsets in some degree the bad reputation which rests upon his native State in matters which relate to an open mind.

The example furnished by Professor Baird in bringing the intelligent attention of Congress to scientific methods of inquiry should not be forgotten.

That the endeavor to wrest the truth from our surroundings be not palsied by the belligerent forces of traditionalism must be the concern of all who are striving for that freedom which is the reward of those who seek and find the truth.

WHY THE WOODS HOLE CHORAL SOCIETY?

Dr. Edwin Linton, President of the Woods Hole Choral Society gave the following introduction before the opening number:

Information has come to me to the effect that many people have been asking what the purpose may be of this Choral Society, to whose initial concert you have come this evening.

Now, in any community other than this one, nobody would think of asking such a question. The organization of such a society elsewhere would be accepted with no more question as to the reason for it than would be asked of a sewing-circle, a spelling bee, or a horse-shoe tournament. But in this community where the quest for an answer to the riddle of natural phenomena is the business of nearly everyone, the desire to know the why and how, the whence and whither of everything, new or old, is a perfectly natural response to environmental conditions.

The shortness of the time which is at my disposal, and the presence of the chorus on the stage necessitates the elimination on this occasion of lantern slides showing mathematical formulae, and logarithmic graphs, which are needed in a complete demonstration. The answer to the question: Why a Woods Hole Choral Society? therefore, must be attempted through the old-fashioned method of word of mouth.

1. In the first place, music hath other charms than that of serving as anodyne to soothe savage breasts, and there are a goodly number of people in the community who derive a great deal of pleasure from choral singing, and who are willing to devote a part of the time which they would, and should, give to recreation to the practice of choral singing.

2. A second reason is to be found in the excellent opportunity which is afforded by existing conditions for becoming acquainted with music which a highly competent teacher of music pronounces to be good.

3. And a third reason is the opportunity which is here afforded to secure training in choral singing under a director of long and approved experience.

The impelling force of these three reasons, viz., the enjoyment which is found in choral singing, an opportunity to become acquainted with good music, and the advantage of receiving training at the hands of a master of his art, has caused the Woods Hole Choral Society to come into being.

Towards the close of the season of 1926, mainly through the initiative and constructive enterprise of Mrs. Glaser, the desirability of organizing a choral society was brought to the attention of a number of persons. Many of us had heard with delight some years ago, on the grounds of Mr. Charles R. Crane, the superb work done by the famous Russian choir, which had been trained, and was under the directorship of Professor Gorakhoff, now professor of music and director of choral singing at Smith College. When it was learned that he had agreed to train the chorus, a sufficient number to justify such an organization were quickly found. Music was secured, and a few meetings for practice were held last summer. As soon as a sufficient number had returned this season practice was resumed.

We have found in Professor Gorakhoff a teacher who not only shows us how we ought to sing, but, by way of a chastening contrast, he now and then shows us how we do sing.

The time which has been given to our training may have been too short to cause our newly acquired characters to prevail over ancient habits and inherited tendencies. The preformance which we are about to give, may be regarded, therefore, as an exhibition of Professor Gorakhoff's experiment in extracting harmony from such more or less refractory material as came to his hand.

The Simple Arthropod

(*Tune:—"Die Lorelei."*)

There was a simple arthropod
Upon the summer sea;
They caught him in a lobster-pot
And brought him home to me.
I cut his little carapace
About his little gills,
And watched his unsuspecting heart
Beat soft, subconscious thrills.

I jerked his little walking-legs
From out his body-wall,
Till of that simple arthropod
There was nothing left at all—
Nothing left but diagrams
Of what he ought to be,
And there's an empty lobster-pot
Upon the summer sea.

The Choral Society

(Continued from First Column)

THE COLLECTING NET

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Pearce Gives Lantern Slide Lecture on the Animal Life of Nigeria

"The Natural History of Nigeria", was the subject of the lecture given last Thursday evening in the old lecture hall under the auspices of the Bureau of Fisheries. The lecture was given by Dr. A. S. Pearse, professor of zoology at Duke University. Dr. Pearse has contributed much to our knowledge of the fresh-water fishes and has recently written a book on animal ecology. He was sent to Africa by the International Health Board to work with the West African Yellow Fever Commission. Yellow fever in Africa appears to be a different disease from that in the western hemisphere and at the present time the causitive organism and its carrier is unknown.

Dr. Pearse used a large number of colored lantern slides illustrating in an excellent manner the country through which he travelled and worked. The pictures were taken by himself and developed under great difficulties in the tropical countries and were later colored by him upon his return.

Among the interesting animals described were the "Gobies" a species of fish which leave the water and climb up on trees or other objects projecting from the water. They are enabled to live out of the water

(Continued on Page 5)

Currents in the Hole

At following hours the current in the hole turns to run from Buzzards Bay to Vineyard Sound:

DATE	A. M.	P. M.
Aug. 20	10.54	11.45
Aug. 21	11.59	.....
Aug. 22	12.42	12.57
Aug. 23	1.40	1.55
Aug. 24	2.44	2.51
Aug. 25	3.35	3.46
Aug. 26	4.21	4.37
Aug. 27	5.08	5.16

In each case the current changes six hours later and runs from the Sound to the Bay.

M. B. L. Calendar

Wednesday, August 24
8:15 P. M.

Moving Picture and Lecture. "The Tale of an Ancient Mariner." Presented by Chester Scott Howland. Reserved seats, $1.00. General admission, 50c. For the benefit of *The Collecting Net* Scholarship Fund.

JAPANESE HAVE SISTER MARINE LABORATORIES

By Arato Terao
Professor of Zoology, Imperial Institute of Fisheries, Tokyo, Japan

The word "sister" may be shocking even to the broad-minded American scientists. But the fact is that such distinguished scholars of this country as Drs. Dean, Jordan, Kincaid, Harvey, and Tennent have favored our laboratories with their generous sojourns. It is also our pleasant recollection to have had the eminent European biologists, Drs. Doflein (Germany), Mortensen (Denmark), Bock (Sweden) and Molisch (Austria), coming there for their works.

The oldest of our laboratories is the Misaki Marine Biological Station of the Tokyo Imperial University. It is situated about thirty miles southward from Tokyo and noted for its easy access to the unusually rich fauna and flora. No less abundance in the variety of life is found around the Takanoshima laboratory of the Imperial Fisheries Institute, located at the southern end of the Tokyo Bay. The Seto laboratory of the Kyoto Imperial University is at 100 miles' distance from Kyoto and in direct contact with the warm current which sustains tropical and subtropical forms. From the stand-point of modern equipment, mention must be first given to the Asamushi laboratory of the Tohoku Imperial University. It is situated on the shore of Aomori Bay. Farther north to this is the Oshoro laboratory of the Hokkaido Imperial University. Its location is 3 miles from Otaru,

(Continued on Page 8)

A RESTRICTED BUT NEW APPROACH TO OXIDATION-REDUCTION IN THE LIVING CELL

By J. Mansfield Clark
Professor of Physiological Chemistry at the School of Medicine of The Johns Hopkins Hospital

Dr. Clark delivered a lecture bearing the above title on the evening of August 5. A summary and a review of the paper follow.

Summary

By L. Michaelis
Resident Lecturer in Physical Chemistry, Johns Hopkins University Medical School.

Since Lavoisier discovered oxygen and at the same time its significance in living organisms, the majority of chemical processes have been considered with respect to the participation of oxygen. Processes in which oxygen is used up or at least in which something analogous to the consumption of oxygen takes place, were designated by the term of oxidation and the reverse process by the term of reduction. The loss of oxygen was considered as analogous to the addition of oxygen and vice versa. Later on changes in valency were necessarily included in this system; the loss of a negative charge being considered as analogous to an oxidation, the gain of a negative charge as reduction. In this sense the change of ferrous ion to ferric ion called an oxidation and the participation of oxygen gradually lost its primary importance for the contradistinction between oxidation and reduction. As such a term as oxidation is too deeply rooted in the nomenclature by tradition, it is necessary to keep the term and shift its definition in such a way that the participation of oxygen losses its primary role. Thus it is most adequate to consider the loss of an electron as the primary step of any process which falls under the category of oxidation. According to what happens after these primary steps the participation of oxygen or hydrogen becomes more or less obvious also. If e. g. the intake of an

(Continued on Page 4)

Review

Barnett Cohen
Chemist, Hygienic Laboratory, Washington, D. C.

To appreciate why the terms "oxidation" and "reduction" have been extended to include such processes as the transformation of ferrous iron to ferric and of indigo white to indigo blue requires historical perspective. It was a long process of dissection at the hands of chemists that isolated particluar aspects of specific oxidation-reduction reactions. As a consequence of emphasis upon one or another of these isolated aspects, we have in modern thought three leading tendencies—that of the physical chemist who describes in terms of electron transfer, that of the organic chemist who describes in terms of hydrogen or of oxygen transfer, and that of the biochemist who is conscious that a century and a half of research has left us very hazy in our concepts regarding the more intimate relation of oxygen itself to the chemistry of our tissues.

These viewpoints, sometimes apparently antagonistic, have revealed the complexities of the general problem; but the recollection that the mechanism of the simplest chemical reaction is still unknown to us should temper our enthusiasm in accepting any of them too implicitly. Under the safe guidance of thermodynamics there are being formulated and experimentally evaluated the energy relations of different systems amenable to attack; and in this approach the question of specific mechanism plays a minor part.

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Fisheries Seminar Hears Drs. Perkins and Galtsoff

The Fifth Meeting of the Fisheries Round Table took place Thursday, August 18, the subject being "Oyster Investigations". The leading speaker was Dr. Earle B. Perkins who is carrying on experimental oyster work at Onset, Mass. Dr. Galtsoff introduced Dr. Perkins with a preliminary talk which was followed by a talk by Dr. H. D. Pease and Mr. Jos. Glancy of the Pease Laboratories, New York City, on the effect of chlorinated water on oysters.

COHEN SUMMARY

(Continued from Page 1)

When the free energy of a chemical process can be made to flow in a purely electrical channel its measurement can be made elegantly exact. Consider, for instance, the case of the reduction of ferric ions to ferrous ions by hydrogen in a solution of definite acidity. The device used in the study of this case is the following. A hydrochloric acid solution is divided and its two containers are connected by a tube made comparatively narrow in order that two processes may be approximately isolated. To one vessel is added a definite mixture of ferrous and ferric chlorides. In the other is placed hydrogen gas at a definite pressure. In each is immersed a bare platinum electrode. This arrangement constitutes an electric cell. Accompanying the withdrawal of current from this cell, there occurs in one of the half-cells the oxidation of hydrogen to hydrions, and in the other half-cell the reduction of ferric to ferrous ions. It is an example of what Ostwald described as "chemical action at a distance". The reaction may be reversed by driving current from an external source against the electromotive force of the cell. In short, the cell is reversible. If now at constant temperature the external electromotive force is nicely balanced against that of the cell and there is attained experimentally one of the nearest approaches to the ideal condition for maximum work. Thermodynamics then furnishes the equation relating the free energy of the reaction to its equilibrium constant.

The free energy in this instance is measured in electrical units, and since we know that one faraday of quantity is associated with the transformation of one gram mol of ferrous to ferric ions, it is useful to center attention upon the intensity factor of the work term, namely, the potential difference of the electromotive force of the cell. It describes the driving force with which a definite pressure of hydrogen, restrained by a definite hydrion concentration, tends to transform an equi-molecular mixture of ferrous and ferric ions towards the completely ferrous state.

For many years this method of study has been applied to inorganic systems, and with success when the systems studied have been well chosen and adequately formulated. These conditions for success are important: for it is to be emphasized that the thermodynamic equation formulates the relation of energy change to some process in general terms, and leaves it to the user first to determine whether the energy change in question is susceptible to measurement by a particular device and, if it is, to discover in the second place what relations among the components of the system will furnish a successful solution. As a guide in the latter task, it is more or less immaterial what scheme of mechanism is postulated (for the final working equation is the same in all cases) but consistency is essential.

A convenient mode of formulation is the following. The difference of potential, E, between an electrode and a solution is assumed to originate in the difference in the escaping tendencies of the electrons in the two phases. This leads to the "fundamental" equation

$$E = C - \frac{RT}{F} \ln e$$

where e represents the escaping tendency of the electrons in the solution system containing a mixture of oxidant and reductant, the interaction of which is described by

$$Ox + e = Red$$

The important consequence of this formulation is that the arbitrarily assumed difference between oxidant and reductant is one which makes the reductant in this case written into an anion. Obviously the oxidant could be a cation and the reductant neutral, or the charges could be otherwise distributed so long as the difference is equivalent to a gain in electrons by the reductant. In any case the reductant is less basic or more acidic than the oxidant, and thus it becomes evident that the hydrion concentration of the solution is a fundamentally important factor.

For the present discussion there is no need to pursue the development of the working equations in detail. It may merely be stated that they include the relation of electrode potential not only to the ratio of total oxidant to total reductant but also to the effects of change in hydrion concentration. Experimentally, it is convenient to study each of these effects separately: that is; (1) to measure in a heavily buffered solution the potentials corresponding to definite ratios of oxidant to reductant; and (2) to measure the changes in electrode potential of a fixed mixture of oxidant and reductant as the pH is changed. The first process discloses whether one or more electrons (or equivalents) are involved in the transformation of reductant to oxidant; the second reveals the existence and magnitude of dissociations of ionizable groups which have been created or destroyed in the reaction. The combined data permit the accurate mapping out of the system over a surface defined by three coordinates, viz: potential, pH and percentage reduction. This laborious mapping out must be performed for the various systems before they can be properly compared as to their relative oxidation-reduction characteristics.

A brief survey will reveal the need of such descriptions for purposes ranging from the more general correlations of the physical chemist to those of the cytologist in his dealing with the conduct of a specific reagent in the oxidation-reduction metabolism of the living cell. We, of the Hygienic Laboratory have been particularly interested in developing a series of indicators useful in detecting intensities of reduction in a manner comparable with the use of acid-base indicators in detecting intensities of acidity. In this connection we must not neglect to repeat that our discussion has ignored the quantity factor of oxidation-reduction, which represents still another aspect of the problem.

We have formulated our equations with the guidance of the postulate of electron transfer. That the resulting equations fit the experimental facts is no argument whatever that the postulate represents actuality. It can easily be shown that the same working equations can be derived with the guidance of other postulated mechanisms, or derived entirely without the guidance of any mechanistic postulate whatever. But once we have the experimental data and realize their independence of mechanistic postulate we are curious to see if they are suggestively in favor of any specific mechanism of oxidation-reduction.

In the first place, it has been definitely shown that the ionization constants appertaining to groups in the reductant created by the process of reduction have distinctly different values. Although an ionization constant is in a sense representative of a statistical state, it may certainly be inferred that a single diacidic anion can and probably does acquire hydrions stepwise. At constant hydrion concentration where the anions would tend to take one hydrion and one only, the oxidation-reduction process in the transformation of methylene blue to methylene white, indophenol to leuco-indophenol, indigo to leuco-indigo, and other organic compounds of similar type involves two equivalents and these equivalents are paired, in the sense that the most accurate measurements have failed to reveal a trace of stepwise reduction. In the language of the organic chemist, this failure to reveal a stepwise reduction in such compounds means that there exists no corresponding intermediate compound which can be isolated. The inference is that in the class of cases referred to the process of reduction is essentially the acquirement of an electron pair followed or not followed by the attachment of hydrions according to the relation of their concentration to the several dissociation constants.

Such electrode measurements as we have been discussing are not generally feasible in organic chemistry any more than they are in inorganic chemistry. Conant has furnished good evidence that certain ethylene linkages are hydrogenated not by any process that is susceptible to electrochemical measurement and formulation, but by the direct addition of hydrogen with the aid of catalysts. There is also the case of direct oxygen addition such as we find in the oxidation of hemoglobin to oxyhemoglobin. Conant could find no evidence that this system can be measured or formulated by the methods we have been considering. On the other hand, he found that the hemoglobin-methemoglobin system can be measured and formulated. The electrochemical method both by its positive and negative evidence is beginning to furnish a background for judging the adequacy of certain theories regarding the mechanism of biological oxidation-reduction.

Few reversible, electromotively active organic systems are found among the compounds which the biochemist has isolated from living cells and from among the products of their metabolism. Yet the favorite tool of the biochemist in his study of biochemical oxidation-reduction has been one of the reversible and electromotively active dye systems, notably that of methylene blue.

(Continued on Page 3)

COHEN SUMMARY

(Continued from Page 2)

It has been shown by Biilmann that in the reduction of certain azo dyes there is a reversible stage followed by an irreversible rearrangement. We have shown that in the oxidation of certain diamines, such as benzidine, there is a reversible stage followed by an irreversible process which we infer to be a certain type of autoxidation. Conant offers a very good rational interpretation to the otherwise still useful empirical potentials defining what reagents will produce an irreversible reduction and what reagents will not. Thus in the study of irreversible reactions there is being stimulated the search for that type of intermediate, reversible change which is amenable to formulation and to definite measurement by the methods here described.

In our own work dating from 1919, we have found that the effects of cell suspensions upon electrodes were as if some system or systems in the cell had a definite electromotive activity. Cannan, Cohen and Clark recently obtained results which can best be explained at present on the hypothesis that the living cell activates some of its metabolites in such a way that there is produced an extremely small quantity of electromotively active material. This the cell continues to supply from a comparatively large reserve. The smallness of the quantity present at any moment accounts for the precarious nature of the potentials observed. The definiteness of some of this material would account for the definite trend of potentials and the interaction between cell suspension and reversible oxidation-reduction indicators. The results entirely freed from postulates lead to a powerful experimental method of attack.

The reaction between succinic acid and methylene blue leading to fumaric acid and methylene white might presumably alone reach an equilibrium, but this would probably take a very long time. In the presence of muscle tissue the attainment of equilibrium is greatly hastened. Thunberg, observing the extent to which the methylene blue system is transformed and using our data for the methylene blue system, calculated the potential to which the fumaric-succinic system is transformed by muscle tissue. His value is plus .005 volts at pH. 6.7. Essentially the same equilibrium was found by Quastel who worked with resting bacterial cells.

The potential found for cell suspensions containing this succinic-fumaric acid system is distinctly negative to that which the Needhams on the one hand and Wurmser and Rapkine on the other are finding in aerobic cells by micro-injection of oxidation-reduction indicators. The region of potential that they find is confirmed by other types of experiment. In short, certain very different types of experiment converge to the conclusion that the aerated cell maintains a potential distinctly oxidative to the methylene blue system and distinctly reductive to certain indophenol systems. But this is enormously far distant from the potential of any system in equilibrium with the oxygen of our atmosphere. We can see no other conclusion than the following: In the perticipation of oxygen in the chemistry of the living cell there is, on the one hand, no potentiometrically measurable oxygen equilibrium and yet, on the other hand, there is some means by which the oxygen, contending against the reductive processes of the cell, maintains a more or less definite and potentiometrically measurable level of oxidation-reduction intensity. There is additional support to this view and the promise of useful extension of our knowledge in the results from micro-injection studies now being completed by Drs. Chambers, Reznikoff and Pollack in collaboration with Dr. Cohen.

We never find electrode potentials more positive than about +.2 volt at pH. 7 as measured both by indicators and electrode even after air has been bubbled through a cell suspension. Cultures of certain anaerobic bacteria, as measured by electrodes and independently by such indicators as are available for rough estimates, can induce not only the potential of the hydrogen electrode but also a definite although silght overvoltage. Of significance in this connection is the fact that under the conditions imposed, these organisms are able to liberate free hydrogen from the medium as a product of their metabolism.

The question of biological oxidation-reduction now appears to resolve itself into two distinct aspects: the problem of the catalysis of oxygenation as a special aspect of oxidation applying to the aerobic metabolism of the cell; and the problem of the catalysis leading to that type of oxidation-reduction which can be formulated by the electrochemical methods here discussed, and studied when the cell is under anaerobic conditions.

The Collecting Net

A weekly publication devoted to the activities of the Marine Biological Laboratory and of Woods Hole in general.

(*Application for entry as second-class matter is pending.*)

The Universal Press
New Bedford Woods Hole
Massachusetts

The Club Plays

There seems to be a difference of opinion in regard to the program presented for the benefit of the Social and Tennis Clubs on the sixth of August. In general the older and more conservative people regarded it as not measuring up to the standards of the laboratory community either in taste or in quality. Others considered the performance even more fun than usual. Almost without exception the part acted by the boys—who put on their act with scarcely any help—was well liked.

In the following words we were forewarned:

"In order to meet the varied tastes of the members of our large and complex community—to please the high-brow, the low-brow, and the omni-brow, and to do it in one evening—a diversified feast will be laid before them, and it is predicted that he will be a most ardent pessimist and misanthrope who will not thoroughly enjoy some part if not all of the program."

The consensus of opinion is that the plan did not work. Unless time can be found to present really good plays—and to present them well—we feel that no loss would be incurred in dispensing with this now annual affair. The excellent suggestion has been made that the M. B. L. Club dues of $1.50 be assessed along with the tuition and research space charges. If this could be arranged ample money would be obtained without presenting the customary plays.

This plan would have certain definite advantages. Few people realize or appreciate the large expenditure of energy and time that their production commandeers. Dr. and Mrs. Clark have done a great deal for the laboratory each year in raising the money required to support the Clubs. Their enforced absence during the critical period this summer was too easily evident in the recent productions.

Our Reduction in Size

It is undoubtedly a loss to have this number of *The Collecting Net* reduced in size. But the loss here is a gain to the extent of $40.00 for our Scholarship Fund.

MICHAELIS REVIEW

(Continued from Page 1)

electron produces an anion of a very weak acid and at the given pH this anion combines to a great extent with the hydrogen ions of the solution the whole process appears to consist in an addition of hydrogen and therefore belongs to the oxidation processes even in the older sense of the word whereas really the electron and the hydrogen ion is taken in by the original molecule, one after the other. It is very remarkable that in organic chemistry, probably without exception, the intake or the loss of electrons takes place only in pairs: i. e. a single electron is never taken in or given off but always two at the same time, whereas the combination with the two hydrogen ions corresponding to the two electrons always takes place in steps; first the one and after that the other. This is illustrated in the fact that in any bivalent acid there is a remarkable difference in the two dissociation constants, e. g. hydro-quinone may loose first one hydrogen ion and at a higher alkalinity gradually also the other one, but in the process of oxidation of hydroguinone to quinone there is no intermediate step.

In connection with the newer definition of oxidation and reduction a method can be developed for the quantitative measurement of the intensity of the oxidant or reductant force. In earlier periods of chemistry the quantitative side of oxidation or reduction force was as badly developed as the quantitative side of acidity or alkalinity. Just as the measurement of the electromotive forces of the hydrogen gas chain furnished a quantitative scale for acidity and alkalinity, the measurement of the electromotive forces of an oxidation-reduction-chain provides the quantitative scale of oxidation and reduction power.

Such an oxidation reduction chain consists of two half cells, one of which may be chosen arbitrarily, e. g. a calomel half cell. It represents the standard value of the potential to which the oxidation potential of the other half cell is referred. As a rule the potential of the oxidation chain is referred not to the calomel cell but to a hydrogen gas electrode in which the hydrogen gas has a pressure of one atmosphere and the pH of the solution is zero. The other half cell is the soluton, the oxidation potential of which is to be measured, in contact with an electrode of blanc platinum or gold without any gas. Any solution showing a potential more positive than the hydrogen electrode is an oxidant for hydrogen and according to the greater or lesser potential difference against the hydrogen electrode it is a stronger or a weaker oxidant. There is no absolute boundary between oxidants and reductants, there is only a scale of increasing oxidative power which in reversed order represents the scale of increasing reductant power.

There are relatively few chemical systems in which an oxidation can take place in a reversible way. Most of these systems are solutions of organic dye-stuffs, the reduction of which produces a colourless substance which by oxygen spontaneously and reversibly is restituted to the dye-stuff. 40 years ago Paul Ehrlich utilized these reversible dye-stuffs systems as a scale for the reduction intensity of living tissues. Ehrlich was in this respect far ahead of his time and a quantitative elaboration of this idea could be only performed after the theory of oxidation-reduction-chains had been developed. The theory of these chains was given twenty years ago by Peters who utilized Nernst's theory of galvanic chains for the case of oxidation chains. The further elaboration for the more complicated systems such as organic dyes has been performed chiefly by the speaker Dr. Clark. He has not only created an amplification of the theory applicable for any particular case which may occur but also showed the intrinsic relations between oxidation potentials and pH. Whenever the oxidised form of a dye stuff is an electrolyte of a different dissociation constant in the reduced form, the oxidation potential of a mixture of the oxidised and the reduced form depends not only on the particular kind of the dye-stuff and the ratio of the oxidised and the reduced form but also on pH. Thus the potential in a dye-stuff system depends on two variables, the concentration ratio of the reduced and the oxidised form and the pH. In order to represent these relationships in one graph a special coordinate system in three dimensions must be applied.

The speaker succeeded in establishing a whole set of such dye-stuff systems mostly belonging to the Indophenols and Indigo-dye-stuffs. He selected a suitable group of these dye-stuffs which he syntheszied himself to a great extent and established a set of oxidation-reduction-indicators which can be used as a substitute for potentiometric measurements in the same way as other dye-stuffs can be used for measurement of pH. The oxidation reduction potential of any given solution can be measured by adding a suitable indicator of this series and evaluating colorimetrically the percentage of reduction brought about by the solution to be measured.

These methods were also used in the measurement of the reduction power in living cells and tissues. The dye-stuff method is restricted in so far as a single dye-stuff only covers a small range in the whole scale whereas the potentiometric measurement gives a full picture of the entire course of the potential while the reduction in the living cell goes on. The reduction potential is fully developed only in absence of oxygen but remarkably enough the reducing power as measured by the reduction of dye-stuffs is not in every case in agreement with the potential measured by the gold electrode or with the pressure of oxygen. Obviously the oxygen gas is not in a thermodynamic equilibrium with the oxidable substances in the tissues. In such a case the time factor plays a great role, and the interpretation of the measured reduction potentials is encountered with greater difficulties than in conditions of equilibrium. Different kinds of cells, especially bacteria, approach after a sufficient time of anaerobic conditions different values of reduction potentials. In strongly reducing bacteria, such as bacterium coli which produce hydrogen gas from carbohydrates, the reduction potential will even exceed the value of the hydrogen electrode. Usually the reduction potential will lie somewhere between the hydrogen and the oxygen electrode, indeed much closer to the hydrogen electrode. The role of oxygen seems to be to keep the reduction potential of the tissues far enough from the hydrogen potential. Thus a new problem concerning the role of oxygen in life has arisen the solution of which has, by far, not yet been reached.

PEARCE LECTURE

(Continued from Page 1)

for some time and, when disturbed, seldom move back into the water but skip around on the surface. Small vascular chambers invaginated from the branchial cavity function as respiratory organs while the fish is out of water, and account for this peculiar habit. The cast net by which the natives obtain their food fish was described.

The animals in southern Nigeria are all small. The larger mammals such as are found in northern Africa can not live in this region because of the trypanosome diseases carried by the tse-tse fly. A full grown deer shot by Dr. Pearse was only 20 inches in height.

The foraging ants are abundant in Nigeria and their runways built of earth may be seen in the guinea grass regions. These ants are constantly on the move, foraging for food which they obtain from the homes of the termite ants. The foraging ants are usually accompanied by the Bengalia fly which attacks the ants as they return from the termite nests and robs them of their booty.

In southern Nigeria four per cent. of the rats have the plague. A large number of the natives have the plague but a census of this disease among the natives is impossible because they conceal information concerning death and sickness. The dead are often buried beneath the houses.

There are five species of the filaria worm infesting this region. All drinking water is either kept in tanks or boiled before using due to the prevalence of these worms. Dr. Pearse drank only soda water as a preventative while working in the "bush".

Dr. Pearse told of some of the superstitions of the native people. The crocodile is a sacred animal and one large individual is kept in an enclosure and fed on various diets. It is believed that if one of a pair of human twins is fed to the crocodile good luck will forever accompany the family. If twins are not available chickens serve to bring good fortune. Chameleons are ground and dried into a powder, which when mixed with gun powder enables game to be more easily shot. This dried powder is also used to hasten child birth. Many other superstitions keep the people in a state of fear of devil-gods.

Kano is the largest city of the region visited by Dr. Pearse. It is surrounded by a wall 12 miles long and is about 20 feet high and 20 feet thick. It also has large granaries and water reservoirs. Before the British came into control of the country Kano withstood siege from savage tribes for long periods. The British have maintained peace among the natives and little warfare is now carried on. Kano is a well organized city although of a primitive culture.

Dr. J. Mansfield Clark was taken by sailboat to New Bedford on Wednesday, Aug. 10, where he took a train to Boston. Dr. D. Cohen was captain of the craft and the two were accompanied by Dr. Reznikoff. Dr. Clark made a short visit to Woods Hole and during his stay delivered one of the evening lectures. A summary of this lecture with a review by Dr. Michaelis appears elsewhere in this issue of *The Collecting Net.*

CLIPPED FROM THE LONDON TIMES

The following letter has been submitted by "pH. D.":

Dear Sir:—

I am Wang. It is for my personal benefit that I write for a position in your honorable Bank.

I have a flexible brain that will adapt itself to your business and in consequence bring good efforts to your goodselves. My education was impressed upon me in the Peking University in which place I graduated Number One.

I can drive a typewriter with good noise and my English is great.

My references are of good and should you hope to see me they will be read by you with great pleasure.

My last job has left itself from me for the good reason that the large man had dead. It was on account of no fault of mine. So, honorable Sir, what about it? If I can be of big use to you, I will arrive on some date that you should guess.

Faithfully yours,
Wang.

Spermatophytes[1]

Who walks by ocean, lake or stream
Notes how the matted *Algae* teem,
Who feeds on mushrooms or on yeast
Doth draw on *Fungi* for his feast,
He who in mossy banks delights
Shall couch himself on *Bryophytes*,
Who after ferny dells doth spy—
Pteridophytes shall glad his eye;
Sweet flowers, tall grain, and mighty trees—
Spermatophytes embrace all these.

[1] Science News Letter, Nov. 6, 1926

THE CHEMISTRY OF THE VITAMINS

By Dr. Blanchard

Just thirty years ago, the Dutch physician Eijkman first observed the unique syndrome of avian polyneuritis in hens whose diet had been restricted to polished rice. He compared this condition to the human disease beri-beri, and showed that it could be relieved by a diet containing either rice hulls or their aqueous extract. Approximately a decade later, Hopkins pointed out that animals could not deevlop and live upon an apparently complete diet consisting of proteins, fats, carbohydrates, and inorganic salts, without the addition of unknown accessory food factors. We may properly regard these observations as the beginning of experiments with those peculiarly elusive entities now termed the vitamins.

After the passage of another ten years, a host of investigators concentrated their attentions upon these substances, with the result that it soon became evident that vitamins are apparently not proteins, not glucids nor lipins, but are organic in nature, and are indispensable for the proper metabolism of organisms incapable of synthesizing them from the elementary foods. Although knowing absolutely nothing about their structure or chemical identity, biochemists now recognize the existence of six such substances. These have been termed respectively vitamin A, B, C, D, E, and P-P. The omission of any one of them from the diet produces a unique pathological condition which may be relieved by a diet abundant in the missing vitamin. In the absence of Vitamin A, growth ceases, and experimental animals develop the eye condition, xerophthalmia; in the absence of B, young animals cease to grow and adults develop beri-beri; in the absence of C, scurvy occurs, the scourge of the wind-jammer crews and explorers; the absence of D results in rickets, to be observed in children in any tenement district; without E, sterility is produced; and without P-P, pellagra ensues.

In recent years, by means of thousands of feeding experiments, the distribution of these substances in food stuffs has been carefully determined. Few investigators, however, have turned their attention to the concentration, isolation, and chemical characterization of these interesting components of our food.

In a recent evening lecture, Dr. Drummond, of the University of London, discussed in some detail the results obtained by those few investigators who have sought to isolate the various vitamins. He described in some detail the method used by Jansen and Doneth, who extracted 100 kilos of rice polishings with acidified alcohol. The active principle in the extract was adsorbed on clay, desorbed, and then subjected to a series of fractional precipitations with silver salts. Finally a few tenths of a gram of material possessing all the vitamin-activity of the original 100 kilos were obtained. This material was remarkably active, .000002 gram daily being all that was necessary to keep animals on a vitamin B-free diet in a healthy condition. Although these authors have determined the empirical formula of the substance to be $C^6H^{10}ON^2$, unfortunately they did not determine its molecular weight; hence it is impossible to say whether this is the true formula or only the simplest one. Professor Drummond pointed out the important fact that the vitamin B itself might possibly be present in much smaller quantity, adsorbed upon the compound isolated.

He next discoursed upon the progress made by Zilva of the Lister Institute, in obtaining a vitamin C concentrate. This investigator has succeeded in obtaining all of the anti-scorbutic activity of a liter of lemon juice in a fraction weighing less than 0.03% of the original juice. While this product is by no means a pure substance, it has a truly remarkable anti-scorbutic activity.

The lecturer followed this by a discussion of one of the most interesting phases of modern biochemistry—the characterization of the anti-richitic factor, vitamin D. It was early found that this substance was present in the non-saponificable fraction of cod-liver oil. Drummond and his associates succeeded in obtaining a more concentrated preparation, by distillation in high vacuo. Later Steenbock in this country, and Rosenhain and Webster in England, discovered that cholesterol, which had absolutely no anti-richitic activity, could, by irradiation with ultra-violet light, be converted into a mixture possessing the activity of vitamin D preparations. The biochemists immediately saw a possibility of obtaining this substance in quantities sufficient for identification. Unfortunately only a very small quantity of the cholesterol was endowed with anti-richitic properties by ultra-violet radiation. For some time, however, this fact was viewed with curiosity rather than from the standpoint of organic chemistry.

Drummond finally succeeded by tedious fractional recrystallization in preparing a sample of cholesterol of higher melting-point than any previously obtained. In his lecture he stated that he was "inordinately proud of this achievement", but was soon disappointed on finding that the sample could not be rendered active by ultra-violet radiation. Seeking an explanation, he took it to the organic chemist Heilbronn, who, on spectroscopic examination, quickly ascertained that its absorption spectrum differed by three bands from that of ordinary preparations of cholesterol, although the chemical properties of the two were identical. It followed then that cholesterol as ordinarily prepared contained a very small amount of an impurity responsible alike for the three absorption bands and the anti-richitic activity developed by irradiation. Attention was thus focussed upon a large number of cholesterol derivatives previously prepared by the German chemist Windaus, who has devoted his life to untangling the structural mysteries of cholesterol and its derivatives. Windaus readily cooperated with the English investigators, and with Hess in America, with the result that the sterol, ergosterol, was found to possess not only the three absorption bands missing from Drummond's preparation of cholesterol, but also the property of yielding, on ultra-violet irradiation, a vitamin D preparation effective in preventing rickets, when used in almost unbelievably small doses.

Unfortunately we do not know precisely the structural configuration of either cholesterol or ergosterol, it is impossible to ascertain the structure of vitamin D. This problem, moreover, is not likely to be solved by any except a skilled organic chemist trained in untangling molecular intricacies. It is known, however, that ergosterol is a more unsaturated compound than cholesterol, and it seems a reasonable assumption that its activation is in some way connected with alterations in the configuration of the unsaturated linkages—possibly a simple polymerization. Such speculation, however, will be fruitless until we know more concerning the structural chemistry of the parent substance—ergosterol.

James Harvey Robinson Leaves for Dartmouth

James Harvey Robinson, historian, and author of "Mind in the Making", who has spent the summer in Woods Hole, left on Wednesday evening for Dartmouth where he will attend a conference on social science and will discuus his own methods in the art of teaching and of presenting facts. The title of his lecture will be "The heavy traditions of book making".

Prof. Robinson, a quiet person with iron grey hair, a rather determined looking moustache and intent grey eyes, has spent the summer taking the course in protozoology because he wanted to find out a little more about life, and his determination to find out has extended well beyond the laboratory. Prof. Robinson's room at the Mayflower Hotel is equipped with a laboratory table fitted with microscopes accompanied with cultures of protozoa which he has a habit of taking home from the class room and of studying until the early hours of the morning. His equipment and the systematic arrangement of his material would be a credit even to a professional biologist.

It is his contention that if social science is to be made into something more than an amateur slumming trip it must begin with a study of biology. The biological processes, Prof. Robinson says, control human activity, and human behaviour is based on fundamental biological reactions. It is impossible to try to understand civilization and groups of men without first understanding their evolutionary background.

Prof. Robinson, who has for years studied educational methods, was most favorably impressed with the way in which the laboratory courses were conducted. He expressed his appreciation of the laboratory by presenting the editor of *The Collecting Net* with a check for $100.00, as a "token of appreciation of the laboratory", to be used for the Scholarship Fund, or in any way which might best serve the laboratory.

In discussing his work in the class room this summer Prof. Robinson suggested that if a dark-field condensor and a Greenough microscope were placed at the disposal of the students it might help them greatly in seeing their specimens from different angles and in identifying them with a better understanding.

Prof. Robinson does not approve of American education in general, since so much of it is cut and dried rote work that glorifies memory instead of rationcination. In the martial atmosphere of an examination room a student can not do his best work, and in general conditions are not conducive to clear thinking or good memory. Mr. Robinson regards the Phi Beta Kappas as a "bunch of boobs" and does not consider them any more capable and intelligent than any other similar group. There are exceptions, of course, but in general they must submit to stereotypism and a premium is placed on memory.

Prof. Robinson is much interested in the question of presenting difficult subjects to the non-specialist in a way that they can be easily comprehended. When people write they must keep constantly before them the kind of persons to whom they are writing and adapt it to their mental make-up. Writing of this kind is a science in itself and Prof. Robinson has thought and worked on this problem for years. This he has well shown in his "The Humanizing of Knowledge".

He is now engaged in editing a series of books called "Humanizing Knowledge" in which he and his fellow editors, especially Daniel T. MacDougall, present facts with a technique that will attempt to stimulate rather than repel the incipient thirst for knowledge.

Dr. and Mrs. R. B. Little from the Rockefellow Institute in Princeton, N. J. are visiting the Laboratory for a week.

Dr. Read Ellsworth, who worked last summer in Woods Hole as associate of Dr. L. Michaelis visited last week on a trip to Boston.

The following members of the National Academy of Sciences have been in residence at the Marine Biological Laboratory during the present season: Drs. G. H. Parker, T. H. Morgan, E. G. Conklin, L. L. Woodruff, B. M. Duggar, C. R. Stockard, C. E. McClung, F. R. Lillie, H. S. Jennings and H. H. Donaldson.

THE SEA CUCUMBER

Beneath the waves the sea cucumber
Spends all his hours wrapped in slumber,
And he does not appear to see
The gay, aquatic scenery.
It seems a most cucumbrous way
Of drowsing thru the sunny day.

Olga Marx

CAMOUFLAGE

Some students though they'd fool a Prof.
And at his helpless poundering scoff.
To him they lug, with faces smug,
A neatly glued composite bug.
They tell a tale how they came by it,
And ask him to identify it:
The Prof glanced o'er his glasses marge—
"The student hum-bug—CAMOUFLAGE".

pH. D.

THINGS WENT ASKEW ABOARD THE LOU

(Clipped from the Vineyard Gazette)

The night was dark, peace hovered nigh, all Woods Hole was asleep, when down where all the moored boats lie did bold miscreants creep. They saw the good ship Lou hauled out upon the railway there while sounds of snoring surged about and shook the midnight air.

'Twas Captain Nelson Luce who slept the slumber of the just, while nearer these marauders crept through blockings, chains and dust, until they reached the shadow cast by Nelson's land-bourne bark. Oh then the moon above the mast looked down on doings, dark!

The shackle from the chain was knocked, the wedges all drawn back from where the cradle wheels were chocked upon the railway track. Then with a heaving bar they worked, they twisted and they pried until the laden cradle jerked and started for the tide.

Within the cabin Captain Luce uprose from off his bed and vaguely mumbled, "What the deuce!" as carlines bumped his head. And ere the deck came to his view, though speeding from his berth, the cradle quickened and the Lou forsook the solid earth!

He gained the stairs and deck at last, the moon peeped from a cloud, the cradle held the Lou still fast and Nelson groaned aloud. Between him and the dry beach sand the harbor waters rolled while from a steeple near at hand the hour of midnight tolled.

Philosophy did aid him there; it was a waiting game. He went below and slept again until the morning came. Then hailed a passer-by who strode along the harbor sand and launched a boat to row the captain safe to land.

All turned out well but Captain Luce declares it is no joke to suffer such ill-timed abuse and have his slumber broke beside to suffer fear and shock lest harm befall his boat and, worst, to stick as on a rock, at sea but not afloat!

Note: Captain Luce is in charge of the fish traps at the laboratory. The italics are ours. We wanted our local readers to know that someone, at least, appreciates "the dry beach sand" of the Eel Pond shore!

TO CHEVROLET OWNERS

A Verse for Land Animals

Our fruitful mother Chevrolet
Has many children under way.
It makes a person feel quite bitter
To count a million in a litter
And feel that nevermore can he
Compete with such a progeny.

Olga Marx

JAPANESE HAVE SISTER MARINE LABORATORIES

(Continued from Page 1)

a north-western seaport of Hokkaido. It may be mentioned that another laboratory is now under construction at Amakusa by the staff of the Kyushu Imperial University. There is every sign that the newly established Formosa Imperial University will have within a few years its own marine laboratory on that island. Really, the study of marine forms has been one of the favorite fields of research in Japan, just as the people of the Great Britian have had strong propensity for the mariners' life. It will, therefore, not be surprising to find that several Japanese zoologists have been assigned to work up some of the collections of the *Albatross* and *Siboga* expeditions and that the students of Princeton University have to be quized with *Cypridina* from Japan.

A meeting of the executive committee of the Division of Biology and Agriculture of the National Research Council was held at the Laboratory on Aug. 8th. Present were Dr. William Crocker, Chairman. Dr. L. L. Woodruff, vice-chairman. Drs. L. J. Cole, B. M. Duggar, C. E. Allen, M. M. Metcalf, C. E. McClung, S. O. Mast, R. A. Harper, J. R. Schramm, F. R. Lillie, and A. Thatcher.

Dr. A. Terao, professor of Zoology at the Imperial Institute of Fisheries, Tokio, Japan, who spent the last winter with biometric studies at the Institute for Biological Research in Baltimore, came down to Woods Hole to experiment on the influence of uranium and radium radiations on the early cleavage stages of Chaetopterus.

Dr. Tetsuo Inukai, Assistant Professor of Zoology at the department of Agriculture in the Hokkaido Imperial University, Sapporo, Japan, arrived in Woods Hole last week to spend the rest of the season on research work in Vertebrate Embryology. He will work at the Wistar Institute of Anatomy and Biology in Philadelphia this Fall.

Dr. N. Yagi, Assistant Professor of Entomology at the Kyoto Imperial University, Kyoto, Japan, arrived in Woods Hole on August 11. He spent some time at the Department of General Physiology at Harvard University and is studying down here on various themes of a biological nature.

THE COLLECTING NET

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SUPPLEMENT IN COMMEMORATION OF JACQUES LOEB TO APPEAR THIS FALL

Editorial Announcement

On the afternoon of August 4 exercises were held in the auditorium of the Marine Biological Laboratory on the occasion of the unveiling of the Memorial Tablet to Jacques Loeb. Because of this and owing to the many years in which Dr. Loeb has been intimately associated with this Laboratory, and the great influence of his work on the type of investigation which now so largely prevails, it is fitting that *The Collecting Net* bring out a supplement in commemoration of Dr. Loeb.

A feature of this commemorative number will be a full page portrait of Dr. Loeb together with a reproduction of the Memorial Tablet. This picture will be suitable for framing. The remainder of the number will be made up of articles by Dr. Loeb's associates and friends, dealing especially with his life and personality. This supplement will be a greatly enlarged number to accommodate the material that is available.

Our subscribers will obtain the issue without charge, and in case their permanent address is not already on file it should be given to us before December 1.

FIRE DESTROYS SHED OF LOCAL CONTRACTOR

Blazes Laid to Incendiarism

Burning of Hatchville Place Used as Decoy

Fire, believed to be of incendiary origin, destroyed the tool-shed of Sidney W. Lawrence, state highway contractor, and the old Parker place, at Hatchville, early Thursday morning, August 18. The latter, the property of Howard Swift, was reported to be afire at 12:25 a. m., a short while after the close of the banquet which the firemen had held at Woods Hole. The tool-shed was fired while the apparatus was all concentrated at Hatchville.

A few minutes after Elias Ross, of Falmouth Heights, had arrived at his post as watchman for the State Highway construction depot near Lawrence's place, at 2 a. m., he heard talking outside his shed. Going out, he discovered two men lighting matches by the side of the work shop. These men escaped to a waiting automobile upon Ross's approach. When the watchman returned to his post he discovered the tool-shed, which contained equipment valued at several thousand dollars, in flames.

In the meantime, Fire Chief R. D. Wells had returned from the blaze at Hatchville. He was awakened by Officer Veasie Brackett with the news that the sky was aglow. Chief Wells, thinking that the fire at Hatchville had rekindled, ordered the apparatus to that place. When the mistake was discovered the department hastened back to the fire at the tool-shed.

The hazards of the firemen were materially increased by the fact that there were two drums of oil in the burning shed and a large tank of gasoline immediately near it. Fortunately, none of these combustibles exploded.

Three $400 electric transformers formed part of the loss. These were connected to the power line running by the shed.

UNCATENA LAID UP AT VINEYARD HAVEN

On Tuesday morning while docking at the Vineyard Haven wharf the Steamer *Uncatena* met with an accident which has since prevented its scheduled trips. Due to a mechanical defect the connecting rod separated from the piston head. No other damage resulted, though the accident was a dangerous one and it is fortunate that the engineer escaped the long and heavy connecting rod while swinging free.

At the time of going to press we learn that the company expects to have the veteran steamer in service again on Saturday.

Saturday afternoon, August 20, the local fire department answered a report put in by a member of the Coast Guard Station that there was a fire in the rear of the residence of Dr. Warren, on Penzance Road. When the apparatus arrived, a perfectly well-behaved incinerator was discovered doing its duty, although creating great volumes of smoke.

LIBRARY TO GIVE AN ELABORATE PROGRAM

A program of songs, dances and instrumental music will be rendered in the auditorium of the Marine Biological Laboratory on Thursday evening, Sept. 1, at eight o'clock.

Woods Hole is very fortunate in having such an artist here as Miss Ilse Huebner, formerly of Vienna, now with the Cincinnati Conservatory of Music, and a frequent soloist and accompanist with the Cincinnati Orchestra.

She will play some delightful trios for violin and cello and piano—with Mrs. Truman Fassett, cellist, and Richard Warbasse, violinist. The Misses Prossness will add variety to the program by giving a series of dances. Mrs. Truman Fassett will sing a group of baritone songs—and both the cellist and violinist will contribute some celo and violin solos to the program. This promises to be an evening of readily worth while as well as enjoyable music.

SCHOLARSHIP FUND PROJECT SUCCESSFUL

"The Tale of An Ancient Mariner" Presented to a Large Audience

On Wednesday evening, Aug. 23, *The Collecting Net* sponsored a lecture on the whaling industry as it was carried on in days but recently gone by. We were favored by having one of the best authorities speak to us on the subject, Mr. Chester Scott Howland of New Bedford, who is a son of Capt. George L. Howland, for many years the skipper of the Bark Canton. In 1890 Captain Howland was honored by the government of Great Britain for the heroic rescue of 16 members of the crew of the Bark "British Monarch" burned at sea 700 miles off the coast of Africa. The lecture was very fully illustrated with both moving pictures and lantern slides. The uses of several whaling weapons and implements were demonstrated:—harpoon, shoulder bomb-gun, bomb lance, killing lance and others. Possibly the mincing knife, of "Bible-leaf thinness" ability, will remain longest in the memory of the actively religious audience.

Of the four kinds of whale extant, the sperm whale was the most highly prized, owing to its valuable yield of spermaceti. The voyagers pursued their quarry all over the world and on the average a single expedition lasted over a period of three years. The longest on record covered the time of eleven long years. All Woods Holers have known ever since they became Woods Holers that they are in the general vicinity of the headquarters of the old whaling industry; but to have the tremendous significance of New Bedford and Nantucket in this industry forcefully impressed upon them was much appreciated. Several delightful musical numbers were rendered by Herman Field, violinist, and Blanche Nelsen, pianist.

Professor Conklin, chosen to introduce the speaker because of his peculiar fitness for the

(Continued on Page 2)

The Collecting Net

A weekly publication devoted to the activities of the Marine Biological Laboratory and of Woods Hole in general.

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(*Application for entry as second-class matter is pending.*)

The Universal Press
New Bedford Woods Hole
Massachusetts

THE COLLECTING NET wishes to extent its heartiest thanks to all those whose spontaneous assistance contributed so largely to the success of the presentation of "The Tale of An Ancient Mariner."

The total receipts from our Wednesday evening performance were $364.00 and the expenses were only $45.00. This leaves a balance of $319.00 for *The Collecting Net* Scholarship Fund.

To the Editor:

We received on July 16th a letter from you, soliciting an advertisement from us and we intended to instruct you to insert one in the next issue of your paper. Unfortunately your letter was mislaid and it consequently escaped our attention until this morning, when it was found while we were looking through our files.

Although we are too late to advertise this year, we are enclosing our check for $5.00 as it is our desire to contribute in this small way and cooperate with you; and for next year we wish to engage a space in each issue of your paper.

We realize and appreciate the wonderful achievements of the Marine Biological Laboratory and wish for you every success.

Very truly yours,
Judah S. Nickerson,
Proprietor.

Falmouth Plumbing & Hardware Co.
Falmouth, Mass.

PERSISTENCY

The brilliant lightning-bug flies swift,
He flashes here, he flashes there,
With constant change of aim, or drift,
That does not get him anywhere.

The humble inch-worm, without light,
Directs himself towards a goal,
And having stretched his limit, quite,
He humps himself, that steadfast soul!

pH. D.

HELEN MORRIS HELPS AVIATORS AT NOBSKA

Due to the modesty of one of our correspondents, Helen Morris, an item of interest which should have appeared a couple of weeks ago was not forthcoming. Now that she has made her departure it seems safe to give a brief account of her unique experience. Many of us in Woods Hole remember that on Wednesday afternoon, August 11, one of the navy airplanes hovered over Woods Hole and its surrounding territory, landing once or twice on the water and often skimming what seemed to be dangerously close to buildings and boats.

It was about five o'clock in the afternoon when the hydroplane landed perhaps a half mile out at sea from the Nobska beach and then came as close as the rough water breaking on the beach permitted. By shouting, those on the plane tried to communicate with the people on the shore, but their voices had to give away to the sound of the wind and waves and were quite unintelligible to those on shore. Helen Morris, one of the dozen or so people over at Nobska beach for a swim, took upon herself the spectacular task of swimming out to the hydroplane to see if she could be of any assistance to those on board. A little later she returned, swimming through the breakers, with a note in her teeth containing a message for Dr. N. A. Cobb of the Fish Commission. She emerged from the water and modestly made a hasty retreat from the ever increasing and admiring crowd.

Currents in the Hole

At following hours the current in the hole turns to run from Buzzards Bay to Vineyard Sound:

DATE	A. M.	P. M.
Aug. 28	5.46	6.01
Aug. 29	6.29	6.44
Aug. 30	7.01	7.25
Aug. 31	7.47	8.06
Sept. 1	8.25	8.51
Sept. 2	9.15	9.35
Sept. 3	9.56	10.26
Sept. 4	10.47	11.15
Sept. 5	11.38	.....
Sept. 6	12.15	12.36
Sept. 7	1.04	1.26
Sept. 8	2.04	2.17
Sept. 9	2.58	3.14
Sept. 10	3.48	4.06
Sept. 11	4.37	4.59
Sept. 12	5.27	5.49
Sept. 13	6.14	6.38
Sept. 14	6.59	7.26
Sept. 15	7.47	8.27
Sept. 16	8.46	9.16
Sept. 17	9.37	10.18
Sept. 18	10.35	11.27
Sept. 19	11.41	.....
Sept. 20	12.27	12.48

In each case the current changes six hours later and runs from the Sound to the Bay.

SCHOLARSHIP FUND PROJECT SUCCESSFUL

(Continued from Page 1)

occasion, said he would give ten years of the peaceful years of his life to repeat the experience of being towed by a harpooned whale.

If we may judge from the evidence of the earth, the whale is the largest animal that has ever lived. It was a fitting introduction to the tale to dislpay comparative diagrams of this mammal and the dinosaur. It made possible a greater appreciation of the intrepidity of the old whalemen than could be gained by a mere reading of Anton Otto Fischer or Hermann Melville.

Mr. Howland is justly proud of his heritage from the rugged New England stock; and for the benefit of the Biological audience he placed emphasis upon the courage and resourcefulness of the mariners as the explanation of their many marvelous escapes, instead of attributing them to special dispensations of the gods. Even Quakers, we learned, could be hard-fisted enough to put the hand-cuffs or thumb-screws on incorrigibles and lash them into an obedient frame of mind. Perhaps the greatest source of danger to the sailors, however, lay in the circumstance that the captain was the ship's doctor as well. Representative drugs of the pharmacopoeia were prescribed and administered by number rather than by name, and the only gauge of the dose was the violence of the symptoms.

The exciting pace of the chase was as well simulated as could be expected of a gasoline launch, and far more realistic was Mr. Howland's repetition of the eye-familiar, but landsman's ear-unknown cry of the lookout: "Thar she Blows! Blo---ows! Blo---o---o--ows!"

Nothing could have so effectively pictured the death-dealing power of a whale's flukes as the close-up of a whale-ship's construction. The huge beams which formed the ribs of the vessel could not by any stretch of the imagination have been damaged by the onslaught of a mad elephant, but it is a matter of cold fact that such craft have been splintered by a wounded whale. The war-cry of the mariners was well chosen: "A dead whale or a stove boat!"

Whales are still hunted and killed for their oil and ivory, but with the advent of safe methods of killing at a distance, the glamor of the chase is gone.

NOBSKA FOG HORN SOUNDS HALF AS LONG IN OCTOBER AS DURING JULY

The following information concerning the weather has been obtained from the "United States Coast Pilot".

Winds. On Nantucket Shoals and through Nantucket and Vineyard Sounds, the prevailing winds are westerly and northwesterly in winter, and southwesterly in summer. From Vineyard Sound westward the prevailing winds are northwesterly and northerly in winter, and southwesterly and southerly in summer, but subject to many variations at all seasons.

Fogs are liable to occur at any season, but are more prevalent from April to October than during the rest of the year. They come most frequently with easterly and southeasterly winds, and occasionally with the wind westward of south. Off Montauk Point and Point Judith, winds between south and southwest are nearly as apt to bring fog as those from southwestward. Westerly and northerly winds clear away fog, this holding good for all parts of the Atlantic coast.

The following table shows the average number of hours per month, from a record of six years or more, that the fog signals were operated at the stated light stations of the United States:

Hours of Operation of Fog Signals

Light Station	January	February	March	April	May	June	July	August	September	October	November	December	Total
Ambrose Channel Light Vessel	123	86	116	86	113	89	69	43	70	57	55	76	983
Cape Cod	92	83	91	78	94	78	96	68	77	72	34	29	892
Nantucket Shoals Light Vessel	50	59	63	83	141	168	184	80	71	63	11	10	983
Nobska Point	**64**	**37**	**34**	**33**	**30**	**41**	**66**	**35**	**31**	**26**	**17**	**17**	**431**
Vineyard Sound Light Vessel	108	80	82	88	98	98	111	82	73	30	38	36	924
Point Judith	90	53	84	79	105	87	109	69	61	35	32	44	848

The effect of strong winds, in combination with the regular tidal action, may at times cause the water to fall below the plane of reference of the chart, mean low water; the lowest level observed below the plane of reference is given under the column headed "Lowest tide". The water has been known also to rise about the same amounts above high water, due to similar causes.

Slack water should not be confounded with high or low water. For ocean stations there is usually but little difference between the time of high or low water and the beginning of ebb or flood current; but for places in narrow channels, landlocked harbors, or on tidal rivers the time of slack current may differ by two or three hours from the time of high or low water stand, and local knowledge is required to enable one to make the proper allowance for this delay in the conditions of tidal currents.

Tides

Locality	Lunitidal interval, high water H.	M.	Mean range Feet	Lowest tide Feet
Cape Cod Light	11	25	7.6	-3.5
Woods Hole	8	26	1.8	-1.5
New Bedford	7	57	4.0	-2.5
Hell Gate	10	45	5.5	-4.0
Governors Island	8	04	4.4	-4.0

Small Craft Warning.— A red pennant indicates that moderately strong winds are expected.

Storm Warning.—A red flag with a black center indicates that a storm of marked violence is expected.

The pennant displayed with the flag indicates the direction of the wind—white, westerly; red, easterly. The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from the southerly quadrants.

By Night, a red light indicates easterly winds, and a white light below a red light, westerly winds.

Hurricane Warning. — Two red flags with black centers, displayed one above the other, indicate the expected approach of a tropical hurricane, or of one of those extremely severe and dangerous storms which occasionally move across the Great Lakes and northern Atlantic coast. These warnings are displayed at all stations on the Atlantic and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Santo Domingo, Turks Island, Bermuda, Haiti, Curacao, Porto Rico, St. Kitts, Dominica, Barbados, Trinidad, and Cuba. Neither small-craft nor hurricane warnings are displayed at night.

FREE SPEAKS AT FIRE DEPARTMENT BANQUET

A banquet was held on Wednesday evening, August 17, for the members of the Woods Hole Fire Department and their invited guests.

Congressman A. M. Free from California told of the work that the government was carrying out in the fostering of raising salmon, and also of the seals on Pribloff Island.

Among other things he informed the audience that the local Fish Commission boat, *the Phalrope,* had been condemned and by next year it will be replaced by a new and better equipped craft and he suggested that those wanting to ride on the old *Philrope* should make use of their last opportunity, and get permission from Captain Robert Veeder to go out on one of his trips this Fall.

Joseph Walsh, Judge of the Superior Court of this district, related his boyhood days in Woods Hole. Mr. Dale, chief of the fire department in New Bedford, spoke in glowing terms of the new pumping engine and the general equipment of the Woods Hole Fire Department.

Walter O. Luscombe and Arthur Underwood, chairman of the Board of Selectmen, complimented the fire department upon its efficiency in its various activities.

The Bureau of Fisheries Laboratory held its annual picnic on August 22 at Tarpaulin Cove. The *Phalarope* left the dock at 10:30 in the morning with the largest crowd aboard—numbering sixty-five in all—that the boat has ever carried.

After the regular New England clam dinner, charades were held in which the older members of the party took part, being awarded with prizes for their very fine efforts. Races were held for the children and kite-flying, target shooting, and other games were indulged in by all. The *Phalarope* returned about 5:00 o'clock and everyone agreed that it was one of the nicest picnics the Fisheries has ever had.